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"Promotion of Knowledge of Materials of Engineering and Standardization of Specifications and Methods of Testing"

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R. E. Hess, Editor

R. J. Painter, Associate Editor

Number 114 January, 1942

Current Research Activities Committees Have Many Projects Under Way

In an address[1] presented some years ago, Dr. Frank B. Jewett, Vice-President, American Telephone and Telegraph Co. and President, Bell Telephone Labs., Inc., in stressing the "importance of facts" referred to his early career as one of the assistants of General J. J. Carty[2] for many years Chief Engineer and Vice-President, American Telephone and Telegraph Co.

"General Carty impressed on me the importance of getting facts before forming opinions or drawing conclusions if one wished to obtain a valid and acceptable answer. It was his belief, and one he operated on consistently, that the answer to almost any question is 90 per cent automatically self-evident if one takes the trouble to assemble and scrutinize the known or ascertainable facts which bear on it. Anyone who was ever involved with him in consideration of some knotty problem will never forget the interminable hours, days, and even weeks or months which he devoted to fact-finding. It was soul- and patience-trying and it lead into most unexpected places and to most unexpected individuals but it got results that were rarely wrong."

The philosophy underlying this discussion is basic in the two important phases of A.S.T.M. work—standardization and research. Only by having factual information on the properties of materials and on adequate methods of test can a suitable standard specification be evolved. Frequently, methods of test can be quickly agreed on which give a reasonably good evaluation of the particular property to be determined. In other cases extensive programs of investigation and cooperative testing must be undertaken before all of the facts are known and agreement can be reached on values or testing procedures. It has been stated many times that research and standardization go hand-in-hand, and it is recognized that a specification or standard test can be competent only if it is based on adequate scientific research and sound engineering judgment.

The following condensed review of current A.S.T.M. research activities is therefore pertinent, not only because of the data which will result, extending still further our knowledge of the properties of materials, but especially so because much of the work will later be the basis of recommendations on standards.

As a specific example of the tie-in between research and standardization, reference could be made to the new work just authorized by Committee A-1 on Steel to provide specifications for valves, castings, and related fittings for use at subatmospheric temperatures. Those in this work will undoubtedly make use of the very extensive report on "Impact Resistance and Tensile Properties of Metals at Subatmospheric Temperatures" sponsored by the Joint Research Committee on Effect of Temperature, published during the fall of 1941. This provides a condensation of available information and data.

An example of the extent of the research necessary to establish a sound basis for a standard test is afforded in the work on "Comparative Fire Tests of Treated and Untreated Wood," carried out by Committee C-5. This most extensive report, appearing in the current *Proceedings*, was

[1] "Some Fundamentals in Standardization—Thirty Years in Retrospect," ASTM Bulletin, January, 1938, p. 7.

[2] It is of interest that General Carty was for years a member of A.S.T.M. representing the membership held by the company.

"Actions Speak Louder

than Words" and with so many of our members in their personal and industrial life extremely active in this War Effort and the fact that our officers and numerous technical committees of our Society have contributed, and more will contribute, materially of their time and specialized knowledge—now more important than any time in our national life—make hollow almost any statement we can set forth. Yet we do record our pledge to do all in our power, to devote the pages of this ASTM Bulletin and other A.S.T.M. publications wherever desirable, and confidently to affirm on behalf of our Officers, Members, and the Staff our individual and collective efforts to attain an early and decisive Victory and thereafter, as President Lundell has put it, to aid in writing a specification that will bring lasting peace, happiness, and prosperity for *all*.

The Editors

the basis for the new Tentative Method of Test for Fire-Retardant Properties of Wood (C 160 – 41 T).

The information which follows is not intended to give a detailed picture of any specific phase of A.S.T.M. research work, but does provide an over-all picture of the large number of projects under way. Basically, it is an *ad interim* report and thus differs from the complete article published in the October, 1940, BULLETIN.

Most references given are to the 1941 *Proceedings* now in the mails, and where no references are included, the information presented covers essentially the material which the committees feel it appropriate to announce at this time.

Also, it should be kept in mind in reviewing this material that many research programs are of long duration—for example, the extensive atmospheric tests on corrosion of wire being carried out by Committee A-5 on Corrosion of Iron and Steel—and some are of relatively short duration, completed in say a few weeks or a few months, of which there are examples in the following material. Also, some research may be primarily of bibliographic and statistical nature, but in most cases as far as A.S.T.M. investigative work is concerned, it usually means a great deal of testing in the field or in the laboratory, the results being frequently coordinated with similar tests made under controlled conditions, carried out by other cooperating individuals and companies.

All of this work represents the very considerable measure of cooperation given the Society by large numbers of companies, individuals, federal, state, and municipal departments who are participating in committee and related activities.

Corrosion of Ferrous and Non-Ferrous Metals

Total Immersion Corrosion Tests (Committee A-5).—Excepting the sample plates built into tank ships, the various phases of this research under way since 1920 have been completed. Final reports are anticipated on the behavior of low-copper and high-copper seamless steel pipe specimens exposed for twelve years at Portsmouth, N. H., and Key West, Fla. Final report also in preparation on riveted plate test specimens and on plates built into tank ships. Complete details of tests in sea water of sheet steel and wrought iron specimens published last year. These include committee's conclusions (*Proc.*, Vols. 40 and 41).

Atmospheric Corrosion Tests on Wire and Wire Products (Committee A-5).—Based on 1939 and 1940 inspections, extensive report gives results of tests after exposure for about four years at eleven locations. Extent of corrosion being measured by visual examinations; also by qualitative and quantitative estimations by tension tests and loss of weight tests. Brief tentative conclusions published with extensive tabular data and discussion (*Proc.*, Vol. 41).

Atmospheric Corrosion Tests of Galvanized Sheets (Committee A-5).—Very extensive tests being supplemented by work involving exposure of hand-dip specimens of zinc-coated sheets with varying amounts of aluminum in the coating. Work is to determine whether any difference in behavior can be traced to the amount of aluminum in the coating. Just getting under way.

Galvanic and Electrolytic Corrosion of Non-Ferrous Metals and Alloys—Stainless Steel Coupled with Other Metals (Committee B-3).—Stainless steels, types 304 and 316, to be coupled with numerous other metals including aluminum, copper, lead, zinc, monel metal, architectural bronze and mild steel, at five test locations. Exposure just getting under way (*Proc.*, Vol. 41).

Attention is directed again by the committee to two valuable technical papers in the 1940 *Proceedings*, dealing with corrosion of galvanic couples in sea water, one entitled "Some Observations of the Potentials of Metals and Alloys in Sea Water" by F. La Que and G. L. Cox, and the other, "Controlling Factors in Galvanic Corrosion," by W. A. Wesley.

The Executive Committee

in one of its longest meetings, on January 20, considered many important matters affecting the Society during the Emergency—standards, our publications, District Committees, the continuation of the Secretary-Treasurer's work in the OPM Bureau of Industrial Conservation, other matters, and Research. While no one can foretell the impact of world events on A.S.T.M. research—either the short- or long-time programs—there was unanimous assent that research, leading to the development of new products and uses, was one of several cushions we will need to lessen the post-war impact.

And another point on which everyone agreed, with fervent amens, was the necessity of short—and still shorter—tests. Many of the projects listed in this Research Article are right in this alley.

Ferrous and Non-Ferrous Metals, General

Fatigue of Metals (Research Committee).—A report of investigation on the effect of type of testing machine on fatigue tests results is published in the 1941 *Proceedings*. Several types of machines were used: rotating-beam, rotating-cantilever-beam, vibratory flexural, and direct axial stress. Two steels representing two important types were selected. Report discusses results of endurance limit, effect of shape of specimen, endurance above the endurance limits, and related topics.

Effect of Temperature on the Properties of Metals (Joint Research Committee of A.S.M.E. and A.S.T.M.): *Tubular Members Subjected to Internal Pressures.*—This project included several creep tests on tubular specimens subjected to internal pressures and tension creep tests on carbon-molybdenum steel at temperatures of 700 and 1050 F. Work essentially completed. Report presented at A.S.M.E. annual meeting, to be published in A.S.M.E. *Transactions*.

Comparison of Short-Time Test Methods.—Thirteen laboratories are cooperating with the University of Michigan to conduct some tests and act as a clearing house for data and to prepare the final report. The project involves the comparison of results from nine short-time test methods with those from long-time creep tests on two steels, the 0.35 per cent carbon steel K-20, and a carbon-molybdenum steel K-21.

Properties of Metals at Low Temperatures.—Resulting from this extensive bibliographic research is the extremely valuable publication "Impact Resistance and Tensile Properties of Metals at Subatmospheric Temperatures," a compilation of data from various sources which cooperated with the subcommittee, these data having been classified and supplemented by Dr. H. W. Gillett, with a large amount of material from the literature, principally foreign, added. Critical comments were supplied and a comprehensive bibliography on the subject was appended. Issued as a separate publication in August, 1941.

Life Test for Durability of Electrical-Resistance Wire (Committee B-4).—Further tests under way to determine the effect of ceramics and cements upon the life of heating element materials in contact with them and a second series of tests is under way on nickel-chromium wire comparing the accelerated life test with a procedure in which temperature of the wire is adjusted every 24 hours to the starting temperature.

Tests for Materials for Contacts (Committee B-4).—A preliminary draft of a life test prepared as a result of life tests made on contacts with two devices. Machines following the proposed method are now being used in a series of tests. The same machine may be used for investigations of load-carrying capacity.

Tests for Copper and Copper Alloys (Committee B-5).—Three investigations carried out during the year involving mercurous nitrate test which is an accelerated corrosion test for determining presence of applied or residual stresses which might bring about failure through stress corrosion or season cracking; an expansion pin test; and methods of examination of phosphorized and oxygen-free types of copper. The first two investigations have resulted in new tentative standards for mercurous nitrate test (B 154) and expansion (pin test) (B 95). Two technical papers published in the 1941 *Proceedings*, entitled "Influence of External Stresses on Tendency of Brass Wires to Stress Corrosion Crack, as indicated by the Mercurous Nitrate Test" by H. P. Croft; and "Mercury Cracking Test, Procedure and Control," by H. Rosenthal and A. L. Jamieson.

Anodic Oxidation of Aluminum and Aluminum Alloys (Committee B-7).—A program is under development to compare the performance of anodic coatings in the salt-spray test (B 117) with behavior under atmospheric exposure. Fourteen groups of nine samples each have been prepared, comprising coatings made on two different aluminum alloys and with variations in the electrolyte used for coating, variations in the thickness of coating, and in the method of sealing. Six organizations are cooperating in the testing of these samples and tests which are now under way (*Proc.*, Vol. 41).

Magnetic Analysis

Direct Current Test Methods (Committe A-6).—To check on the accuracy of permeameters used with high coercive force materials, material prepared and checked by various cooperators with results remarkably close. Eventually limits of accuracy of permeameters to be specified (*Proc.*, Vol. 41).

Alternating Current Test Methods (Committee A-6).—As previously detailed, two series of inter-laboratory tests under way on 25-cm. Epstein specimens involving core loss and alternating current permeability with double lapped joints and core loss with butt joints. Ballistic tests also being made. The other series involves incremental permeability tests. In both series checks so far obtained have been fairly good (*Proc.*, Vol. 41).

Spectrographic Analysis

Quantitative Methods of Spectrographic Analysis and Applications (Committee E-2).—A group concerned with copper, nickel, and their alloys has been analyzing standard brass samples to compare existing methods of analysis; the group on zinc, cadmium, and their alloys has cooperative tests under way using the method specified in the A.S.T.M. Method of Quantitative Spectrochemical Analyses of Zinc Alloy Die Castings for Minor Constituents and Impurities (E 27 – 40 T). Experimental work is under way for an internal standard method for analyzing zinc-base die-casting alloys.

Cement

Requirements for Sulfate-Resisting Cement (Committee C-1).—This work involves the study of relative volume change of lean mortar bars when subjected to the attack of aggressive sulfate solutions with about 125 different cements to be included. This is intended to aid in the development of a physical test indicative of sulfate resistance and the correlation of such a test with chemical requirements.

Chemical Analysis.—The work on chemical analysis, which in general has in mind the improvement of existing tests and the development of shorter procedures, concerns principally at this time determinations of free lime, sulfide sulfur, Na_2O and K_2O. For information on recent progress in this work see separate article in this January BULLETIN.

Determination of Strength.—Includes a study in five laboratories of possibilities of the vibration method for placing mortar in the molds for compressive strength specimens. The purpose of this method of molding is to remove variables introduced by manual molding. Another possibility is the machine mixing of mortars for test specimens.

Fineness.—The committee continues its cooperative studies on fineness. Ten laboratories are using the air permeability method described in the January, 1941, ASTM BULLETIN.

Portland-Pozzuolana Cements.—Studies are being made on five portland cements, one portland-pozzuolana, and one cement of low mixture with details published in the current report (*Proc.*, Vol. 41). They indicate the desirability of continued work.

Timber

Fire-Retardant Properties of Wood (Committee C-5).—A most extensive investigation begun in 1937 with five laboratories cooperating covered an investigation of five test methods to determine fire-retardant properties of chemically treated wood. The tests involve the two New York City ones—"crib" and "timber"; Forest Products Laboratory "fire tube test"; "special crib test" developed at Columbia; and the National Bureau of Standards "flame spread test." The extensive data from a large number of tests published in the 1941 C-5 report (*Proc.*, Vol. 41) with comments on the operation of the tests and difficulties experienced. While the loss in weight, except for the timber test, differed over a sufficiently wide range to distinguish between poorly and well-treated material, no one of the methods was acceptable to a sufficiently large part of the interests concerned and on the basis of results Committee C-5 developed a new test, now an A.S.T.M. standard covering tests for fire-retardant properties of wood (C 160 – 41 T).

Lime, Refractories, Gypsum, Mortars

Methods of Testing Lime (Committee C-7).—A series of tests on the various sugar and other methods for determining "available lime" are being conducted in order that standards can be agreed upon for a simple and fairly accurate procedure in evaluating lime products for various uses.

P.C.E. Test for Refractories (Committee C-8).—A comparative study of gas-fired and electric furnaces for determining pyrometric cone equivalent for refractory materials is being conducted. An investigation of testing procedures to cover plastic fire clays is also in progress—this involves calcining clays prior to making the test cones and calcining the cones before making the P.C.E. test.

Heat Transfer of Refractory Materials (Committee C-8).—Comparative studies of thermal conductivity of fire clay refractories involve a use of the hot-plate and the water-flow calorimeter methods; in both cases Globar elements are being used to obtain the necessary high temperatures.

Methods for Determining Purity of Gypsum (Committee C-11).—A study of the ammonium acetate method for determining purity of gypsum and calcined gypsum is being continued and a procedure developed at the National Bureau of Standards is included in the 1941 C-11 report (*Proc.*, Vol. 41).

Methods of Testing Mortars for Unit Masonry (Committee C-12).—The effects of curing using absorbent and nonabsorbent molds and the influence of the shape of the specimen on compressive strength and the durability of mortar when subjected to frost action have all been under study. Comparative studies for methods of measuring plasticity are under way and results have been referred to the committee by various collaborators.

Glass and Glass Products

Soda-Lime Glass (Committee C-14).—Recent studies include the referee and routine methods for chemical analysis of soda-lime glass. As generally agreed upon the procedures were put on trial in five cooperating

(Continued on page 51, with notes on paint, petroleum, rubber, etc.)

Cleveland to Be Scene of March Meetings

UNLESS PLANS go completely awry, the March meetings of the Society will be held at the Hotel Cleveland, in Cleveland, with A.S.T.M. Committee Week scheduled from Monday, March 2 to Friday, March 6. Plans are under way for either a technical session or general meeting of the Society on Wednesday, March 4, comprising what is termed the "Spring Meeting." In all of the plans, the Cleveland District Committee headed by Arthur J. Tuscany, Commissioner, Metal Lath Manufacturers Assn., and Ray T. Bayless, Assistant Secretary and Editor, American Society for Metals, are cooperating.

Thus, many A.S.T.M. members will be visiting the country's sixth largest city, having a population of about 880,000, and which when Moses Cleaveland laid out the public square in 1796 was an isolated trading post on the Western Reserve frontier. The site was chosen because of its trading and commercial possibilities and the rapid growth of the city and its importance justified the selection.

The city's career as a lake port was begun in August, 1818 when the first boat arrived from Buffalo to be followed in 1852 by the cargo of iron ore from the Lake Superior region. Today there are over 2000 industrial plants located in the Cleveland area.

MEETING PLANS

Plans for the session on Wednesday, March 4, are not complete, and it may be necessary to call off this particular activity this year because of the tremendous pressure placed on so many members and others concerned with the materials field during the present emergency. However, it has been proposed that there be a discussion, with leading experts participating, on the importance of rationalization of specifications, and when further progress is made with these plans announcement will be made, probably through the mail, to the members of the committees which are meeting in Cleveland.

COMMITTEE WEEK

Quite a number of technical committees plan to hold meetings throughout Committee Week. In addition to the following committees which have thus far signified their intention of participating, a number of others will undoubtedly convene. It has been the experience in past years that numerous committees decide late in February to have either subcommittee or main committee meetings.

A-1 on Steel
A-7 on Malleable Iron Castings
B-2 Subcommittee III on White Metal Alloys
C-7 on Lime
C-8 on Refractories
C-11 on Gypsum
C-16 on Thermal Insulating Materials
D-1 on Paint, Varnish, Lacquer, and Related Products
D-2 on Petroleum Products
D-3 Subcommittee VI on Determination of Water Vapor Content of Gaseous Fuels
D-4 on Road and Paving Materials
D-8 on Bituminous Waterproofing and Roofing Materials
D-11 on Rubber Products
D-18 on Soils for Engineering Purposes
E-3 Subcommittee B-3 of Division B
E-9 on Research
Technical Committees and Sections of Committee E-1 on Methods of Testing
Sectional Committee A 37 on Road and Paving Materials

Further details of the meetings including hotel reservation cards will be sent to each member, and the officers of the committees meeting will extend the usual call to those on their committees.

Many of the meetings will be of special importance because this is the year that the Book of Standards is published. An earnest effort is usually made by each group to clear up any pending actions on standards so that the specifications and tests can be in the best possible shape for inclusion in the Book of Standards.

"Flame Spread Test of Fire-Resistive Shingles"

Honorable Mention, Non-Professional, in the Fourth A.S.T.M. Photographic Exhibit, by Ben Caldwell, Underwriters' Laboratories, Inc.

New Technical Advisory Committees Approved in National Emergency Steel Specifications Work

THE PERSONNEL of several new technical advisory committees to function in the development of national emergency steel specifications has been approved and the membership of four of these groups is itemized below. The personnel of the first four committees formed (carbon and alloy plates, aeronautical steels, and structural shapes) was listed in the December ASTM BULLETIN, p. 11.

As previously announced, this work, launched in the Office of Production Management and for which C. L. Warwick is Administrator, is being carried out by the A.S.T.M., the Society of Automotive Engineers, and the American Iron and Steel Institute, with the War and Navy Depts. cooperating very closely.

Several of the technical advisory committees have held meetings and in some cases have submitted reports to the Administrative Committee, giving their recommendations on what might be termed "master" specifications. In all considerations representatives of the various Government services have participated and there has been complete harmony with full realization of the importance of this work which the events of December 7 brought into even sharper relief.

No recommendations have been made by the Administrative Committee to OPM because obviously it must have recommendations from a number of technical advisory committees in case additional correlation work is necessary to result in maximum productive effort. At its meeting in Washington on Friday, January 9, the Administrative Committee approved the personnel and general setup for two important new committees, namely, TAC 7 on Carbon- and Alloy-Steel Bars, Blooms, Billets and Slabs, and TAC 11 on Tubular Products. Mr. John Mitchell, Metallurgical Engineer, Alloy, Carnegie-Illinois Steel Corp., will be chairman of the first-named group, while T. G. Stitt, Chief Inspecting Engineer, Pittsburgh Steel Co., has been designated chairman of the committee on tubular products. This latter committee is constituted somewhat differently from the other groups in that it will consist of a Main Committee with six sections or working committees functioning in specific fields. These sections cover Stainless Products, Standard Pipe and Pressure Piping, Pressure Tubes, Oil Country Tubular Goods, Water Well Pipe, and Water Main Pipe. The Main Committee will be made up of the chairman of each section plus one other representative, either producer or consumer—opposite to that of the chairman. Representatives from the War and Navy Departments and other Government branches, and several men who have broad technical knowledge in this field will also be on the Main Committee. Several other societies and bodies have cooperated in recommending personnel for the sections including the American Water Works Association and the American Petroleum Institute.

The Technical Advisory Committee on Tool Steels is practically completed and because of the emergency situation in this field, activities are being rushed.

Technical Advisory Committee 5 on Rails and Track Accessories

Chairman: H. H. Morgan, Chief Engineer, Robert W. Hunt Co.

Government:

Representing the *War Department*
Major Howard G. Hill; U.S.A. Corps Engineer, Room 1163, New War Dept. Bldg., Washington, D. C.

Representing the *Navy Department*
R. J. Potbury; Head of Specification Section, Bureau of Yards and Docks, Room 3421, Navy Bldg., Washington, D. C.

Representing the *Federal Specifications Executive Committee*
Lt. Comdr. G. A. Hunt, Bureau of Yards and Docks, Navy Bldg., Washington, D. C.

Industrial Consumers and General Interests:

W. G. Arn; Assistant Engineer, Illinois Central System, Chicago, Ill.
W. M. Barr; Chief Chemical & Metallurgical Engineer, Union Pacific Railroad Co., 1416 Dodge St., Omaha, Nebr.
C. B. Bronson; Inspecting Engineer, New York Central System, 466 Lexington Ave., New York, N. Y.
E. E. Chapman; Mechanical Assistant, Atchison, Topeka and Santa Fé Railway, 1033 Railway Exchange, Chicago, Ill.
H. R. Clarke; Engineer, Maintenance of Way, Chicago, Burlington & Quincy Railroad Co., 5471 N. Jackson Blvd., Chicago, Ill.
C. J. Code; Engineer of Tests, Maintenance of Way, Pennsylvania Railroad Co., Altoona, Pa.
E. P. Goucher; Engineer of Way and Structures, Capital Transit Co., 36th and M Sts., N. W., Washington, D. C.
B. R. Kulp; Chief Engineer, Chicago & North Western Railroad Co., 400 W. Madison St., Chicago, Ill.
H. H. Morgan; Chief Engineer, Robert W. Hunt Co., 2200 Insurance Exchange Bldg., Chicago, Ill.
W. H. Penfield; Chief Engineer, Chicago, Milwaukee, St. Paul and Pacific Railroad, Chicago, Ill.
G. A. Phillips; Chief Engineer, Delaware, Lackawanna and Western Railroad, Hoboken, N. J.

Producers:

C. A. Burkhalter; Special Agent, Wheeling Steel Corp., Wheeling, W. Va.
Oscar U. Cook; Assistant Manager, Dept. of Metallurgy Inspection and Research, Tennessee Coal, Iron and Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
B. F. Handloser; Superintendent, Dilworth-Porter Division, Republic Steel Corp., Pittsburgh, Pa.
E. F. Kenney; Metallurgical Engineer, Bethlehem Steel Co., Bethlehem, Pa.
L. S. Marsh; Manager, Dept. of Inspection and Metallurgy, Inland Steel Co., 38 S. Dearborn Street, Chicago, Ill.
J. Hart Reece; Superintendent, Metallurgical and Inspection Dept., The Colorado Fuel and Iron Corp., Minnequa Works, Pueblo, Colo.
R. W. Steigerwalt; Metallurgical Engineer, Railroad Materials and Forgings, Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh, Pa.

Consulting Members:

J. G. Morrow; Metallurgical Engineer, Steel Co. of Canada, Ltd., Hamilton, Ontario, Canada
F. H. Saniter; Technical Adviser, Iron and Steel Section, British Purchasing Commission, Room 315, McGill Bldg., Washington, D. C.
Alternate: H. L. Chamberlain; Iron and Steel Section, British Purchasing Commission, 1523 Market Ave., North, Canton, Ohio

Technical Advisory Committee 6 on Wrought Steel Wheels

Chairman: C. T. Ripley, Chief Engineer, Technical Board, Wrought Steel Wheel Industry

Government:

Representing the *War Department*
Major Howard G. Hill; U.S.A. Corps Engineer, Room 1163, New War Dept. Bldg., Washington, D. C.

Representing the *Navy Department*
F. A. Bennett; Asst. Head of Specifications, Bureau of Yards and Docks, Room 3421, Navy Bldg., Washington, D. C.

Representing the *Federal Specifications Executive Committee*
Lt. Comdr. G. A. Hunt; Bureau of Yards and Docks, Navy Bldg., Washington, D. C.

Industrial Consumers and General Interests:

C. B. Bryant; Engineer of Tests, Southern Railway System, Testing Laboratory, Alexandria, Va.
E. E. Chapman; Mechanical Assistant, Atchison, Topeka and Santa Fé Railway, 1033 Railway Exchange, 80 E. Jackson Blvd., Chicago, Ill.
H. W. Coddington; Research and Test Engineer, Norfolk and Western Railway Co., Roanoke, Va.
W. F. Collins; Engineer of Tests, New York Central System, Room 1434, 466 Lexington Avenue, New York, N. Y.
A. M. Johnsen; Engineer of Tests, The Pullman Co., Pullman, Chicago, Ill.
L. B. Jones; Engineer of Tests, Pennsylvania Railroad Co., Altoona, Pa.
K. W. McPherson; Engineer of Equipment, Pittsburgh Railways Co., 435 Sixth Avenue, Pittsburgh, Pa.
C. T. Ripley; Chief Engineer, Technical Board, Wrought Steel Wheel Industry, 310 S. Michigan Blvd., Chicago, Ill.
T. D. Sedwick; Engineer of Tests, Chicago, Rock Island and Pacific Railway, 4747 Wentworth Ave., Chicago, Ill.

Producers:

Oscar U. Cook; Assistant Manager, Dept. of Metallurgy Inspection and Research, Tennessee Coal, Iron and Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Lawford H. Fry; Railway Engineer, Edgewater Steel Co., P. O. Box 478, Pittsburgh, Pa.
E. F. Kenney; Metallurgical Engineer, Bethlehem Steel Co., Bethlehem, Pa.
Reid L. Kenyon; Associate Director, Research Laboratories, The American Rolling Mill Co., Middletown, Ohio
R. W. Steigerwalt; Metallurgical Engineer, Railroad Materials and Forgings, Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh, Pa.
John D. Tyson; Chief Metallurgist, Standard Steel Works Division, The Baldwin Locomotive Works, Burnham, Pa.

Consulting Members:

F. H. Saniter; Technical Advisor, Iron & Steel Section, British Purchasing Commission, Room 315, McGill Bldg., Washington, D. C.
Alternate: H. L. Chamberlain; Iron & Steel Section, British Purchasing Commission, 1523 Market Ave., North, Canton, Ohio

Technical Advisory Committee 8 on Concrete Reinforcement Steel

Chairman: H. P. Bigler; Assistant to the President, Connors Steel Co.

Government:

Representing the *War Department*
H. B. Zackrison; Office of Quartermaster General, Room 3036, Railroad Retirement Bldg., Washington, D. C.
Alternate: Benjamin R. Wood; Office of Chief of Engineer, Room 3214, New War Dept. Bldg., Washington, D. C.
Representing the *Navy Department*
R. J. Potbury; Head, Specification Section, Bureau of Yards & Docks, Room 3421, Navy Bldg., Washington, D. C.
Representing the *Public Roads Administration, Federal Works Agency*
Earl F. Kelley; Chief, Division of Tests, Public Roads Administration, Federal Works Agency, Washington, D. C.
Representing the *Public Buildings Administration*
A. W. Stephens; Public Buildings Administration, Federal Warehouse, Washington, D. C.
Representing the *Federal Specifications Executive Committee*
Lt. Comdr. G. A. Hunt; Bureau of Yards and Docks, Navy Bldg., Washington, D. C.

Industrial Consumers and General Interests:

R. L. Bertin; Chief Engineer, White Construction Co., Inc., 95 Madison Ave., New York, N. Y.
A. J. Boase; Manager, Structural Bureau, Portland Cement Assn., 33 W. Grand Ave., Chicago, Ill.
H. F. Clemmer; Engineer of Materials, Engineer Dept., District of Columbia, 203 Bryant St., N. W., Washington, D. C.
M. Hirschthal; Concrete Engineer, Delaware, Lackawanna & Western Railroad Co., Hoboken, N. J.
H. S. Mattimore; Engineer of Tests, Pennsylvania State Highway Dept., Harrisburg, Pa.
H. H. Morgan; Chief Engineer, Robert W. Hunt Co., 2200 Insurance Exchange Bldg., Chicago, Ill.
F. A. Randall; Consulting Structural Engineer, 205 W. Wacker Drive, Chicago, Ill.
H. H. Scofield; Prof. of Testing Materials, Cornell University, Ithaca, N. Y.

Producers:

W. M. Baldridge; Engineer of Tests, Laclede Steel Co., Alton, Ill.
H. P. Bigler; Assistant to the President, Connors Steel Co., P. O. Drawer 952, Birmingham, Ala.
R. D. Bradbury; Engineer-Director, Wire Reinforcement Institute, 1049 National Press Bldg., Washington, D. C.
H. W. Browall; Dept. of Inspection and Metallurgy, Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
F. T. Bumbaugh; Metallurgical Engineer, Bar & Semi-finished Products, Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh, Pa.
F. C. Elder; Director of Research, American Steel & Wire Co., Rockefeller Bldg., Cleveland, Ohio
O. W. Irwin; Manager of Sales, Concrete Bar Division, Carnegie-Illinois Corp., Carnegie Bldg., Pittsburgh, Pa.
F. A. McCoy; Metallurgist, Sheffield Steel Corp., Kansas City, Mo.
W. Rodgers; Metallurgical Engineer, Republic Steel Corp., Cleveland, Ohio
J. J. Shuman; Inspecting Engineer, Jones & Laughlin Steel Corp., 3rd Ave. & Ross Street, Pittsburgh, Pa.
T. G. Stitt; Chief Inspecting Engineer, Pittsburgh Steel Co., Allenport, Pa.
Henry Wysor; Metallurgical Engineer, Bethlehem Steel Co., Bethlehem, Pa.

Consulting Members:

J. G. Morrow; Metallurgical Engineer, Steel Company of Canada, Ltd., Hamilton, Ontario, Canada
F. H. Saniter; Technical Advisor, Iron & Steel Section, British Purchasing Commission; Room 315, McGill Building, Washington, D. C.
Alternate: H. L. Chamberlain; Iron & Steel Section, British Purchasing Commission, 1523 Market Ave., North, Canton, Ohio

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C. B. Bryant; Engineer of Tests, Southern Railway System, Testing Laboratory, Alexandria, Va.
E. E. Chapman; Mechanical Assistant, Atchison, Topeka & Santa Fé Railway, 1033 Railway Exchange, Chicago, Ill.
E. J. Edwards; Chief Metallurgical Engineer, American Locomotive Co., N. Jay St., Schenectady, N. Y.
O. J. Horger; In Charge of Railway Engineering & Research, Timken Roller Bearing Co., Canton, Ohio
L. B. Jones; Engineer of Tests, Pennsylvania Railroad Co., Altoona, Pa.
J. J. Laudig; Research Engineer, Delaware, Lackawanna and Western Railroad Co., Scranton, Pa.
T. D. Sedwick; Engineer of Tests, Chicago, Rock Island and Pacific Railway, 4747 Wentworth Ave., Chicago, Ill.
R. B. Smyth, Superintendent, Rolling Stock and Shops, Boston Elevated Railway Co., 80 Broadway, Everett, Mass.

Producers:

Oscar U. Cook; Assistant Manager, Dept. of Metallurgy, Inspection and Research, Tennessee Coal, Iron and Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
J. H. Higgins; Materials Engineer, Camden Forge Co., Camden, N. J.
E. F. Kenney; Metallurgical Engineer, Bethlehem Steel Co., Bethlehem, Pa.
R. W. Steigerwalt, Metallurgical Engineer, Railroad Materials and Forgings, Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh, Pa.
G. L. Street, Jr.; President, J. R. Johnson & Co., Inc., Richmond, Va.
J. A. Succop; Research Engineer, Heppenstall Co., 4620 Hatfield St., Pittsburgh, Pa.
C. S. Swanson; General Superintendent, Standard Forgings Corp., 80 E. Jackson Blvd., Chicago, Ill.
John D. Tyson; Chief Metallurgist, Standard Steel Works Division, Baldwin Locomotive Works, Burnham, Pa.

Thermostat Metal*

By S. R. Hood[1]

THERMOSTAT METAL is defined as "a composite metal usually in the form of sheet or strip, comprising two or more metals which, by virtue of the differing expansivities of its components, tend to change its curvature when subjected to a uniformly distributed change in temperature." The name "thermostat metal" has been suggested by the Society as being the most descriptive term available. Other terms describing this material are either trade names or are ambiguous in that they can also apply to laminated metals which are not responsive to temperature changes.

The earliest generally recorded use of thermostat metal is that of Breguet's thermometer invented in 1817. This thermometer used a helix coiled from a laminated strip formed by soldering together three strips—silver, gold, and platinum. The silver, having the highest expansion rate, formed the inside of the helix, and the platinum, having the lowest expansion rate, was on the exterior of the coil. The helix was mounted vertically, supported on one end and having a needle attached to the free end. The needle traversed a graduated arc when a change in temperature caused the free end of the coil to rotate.

In 1831 Ure patented a thermostat to be used to "operate valves, stopcocks, air ventilators, stove registers, etc." This thermostat consisted of a compound bar made by soldering together strips of iron and brass. The warping motion obtained by a change in temperature was multiplied by the use of levers. After this date fairly frequent references to thermostatic devices can be found in the patent file. However, there was no improvement in the thermo-responsive material used. Often the brass and iron strips were merely riveted together.

In 1899 C. E. Guillaume, a French metallurgist, discovered that a 36 per cent nickel, 64 per cent iron alloy, subsequently known as invar, had practically zero expansion rate over a comparatively large temperature range. This alloy was substituted for iron to form a thermostat metal of brass and invar. This combination produced almost three times as much deflection per unit temperature change as the old brass-iron material. Although his combination offered a higher deflection rate, the temperature range in which it could be used was limited by the low strength characteristics of the brass. Gradual improvements have been made by replacing brass first with nickel-copper alloys and then with nickel-chromium stainless alloys. The invar has also been modified to increase the temperature range of uniform deflection. It has also been replaced in some instances by low expansive iron-nickel-chromium alloys. A large number of combinations of two and three laminations have been developed for special applications.

With a few exceptions all metals expand when they are heated and contract when cooled. Different metals expand and contract at different rates. The thermal expansion coefficient of a metal is a comparatively permanent and stable property. Unlike strength and hardness, it is not greatly affected by heat treatment and fabricating procedure. With proper chemical analysis limits and controlled fabricating technique, the expansion properties of a metal can be fixed even more definitely than its electrical properties. Therefore, differential expansion offers a basis for indicating and controlling temperatures over a wide, useful range in an accurate and inexpensive manner.

In selecting an alloy for a thermostat metal there are factors determining the expansion coefficient which must be investigated. The expansion rate on heating and cooling must be identical. Any hysteresis would be highly objectionable. The expansion rate should be reversible not only in the temperature range in which the thermostat is intended to function but also in any range to which it could be subjected. This would include high temperatures if the thermostat metal were to be mounted by soldering, brazing, or welding. Since some otherwise suitable metals exhibit phase changes at low temperatures, it is important that any alloy intended for use at low temperatures should be studied as to its expansion characteristics down to at least −100 F. in order to be sure that no irreversible changes can occur at the subzero temperatures often reached during shipment. In general, single-phase (solid solution) alloys are to be preferred over alloys containing compounds or those which are characterized by a changing solubility of one of their constituents with changes in temperature.

The thermal action of thermostat metal is indicated in Fig. 1 which illustrates the elongation of two metals, one having a high and the other a low expansion rate first when free and again after being welded together.

If a strip of the composite material is straight at some given temperature and if it then is heated, it will bend to form an arc of a circle with the low-expansion material on the inner side. When cooled below the original temperature, it will bend in the opposite direction with the high-expansion material inside. The change in the radius of curvature depends on the difference between the expansion rates of the components, the magnitude and direction of

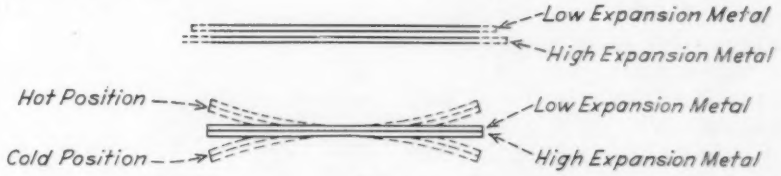

Fig. 1.

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* This paper also appears in the A.S.T.M. Standards on Electrical-Heating and Resistance Alloys, p. 93. (Issued as separate publication.)

[1] Chief Engineer, W. M. Chace Co., Detroit, Mich.

the change in temperature, and the thickness of the composite strip.

The change of curvature per unit of temperature change will be uniform so long as there is a constant difference between the expansion rates of the components. The fact that the expansion rate of a given metal at one temperature may be different from another explains the peculiar shapes of the temperature-deflection curves for some types of thermostat metal.

Materials can be made (1) which will have no deflection until some predetermined temperature is reached, (2) have an accelerated deflection rate, (3) a reduced deflection rate above some predetermined temperature, (4) no deflection above a predetermined temperature, or (5) reverse deflection rate above a given temperature.

Referring again to Fig. 1 it can be seen that at any temperature the high and low expansion components follow arcs of different but definite lengths. As the distance between the inner and outer arcs is reduced, the curvature is reduced. Therefore, when all other factors are the same, the change in curvature will be inversely proportional to the thickness of the composite strip.

The basic characteristic of thermostat metal is its tendency to change its curvature in response to temperature change. Accurate measurements of the curvature change for free strips, therefore, provide a trustworthy index of the thermal performance of any thermostat metal element. The previous considerations combined with the geometric properties of a circular arc give the formula:

$$F = \frac{\left(\frac{1}{R_1} - \frac{1}{R_2}\right)}{T_1 - T_2} t \qquad (1)$$

where:

F = the flexivity or the change in curvature per unit temperature change for unit thickness,
R = the radius of curvature in inches,
t = the thickness in inches, and
$T_1 - T_2$ = the change in temperature in degrees Fahrenheit.

In comparing deflection characteristics of different types of thermostat metal, the values of F as determined by the A.S.T.M. Standard Methods of Testing Thermostat Metals (B 106 – 40)[2] should be used. Deflection constants determined by tests on spiral or helical coils, cantilever strips, etc., are influenced by the mounting method, shape, and dimensions of the element.

In the past, flexivity has not been used directly in the formulas published by manufacturers. There are two reasons for this: namely, the absence of any standardized test procedure and the desire to simplify the mathematics as far as possible. The simplification of the formula for expressing deflection as a function of temperature has been achieved by collecting terms. On this basis the constant K in Eq. 2 is equivalent to $F/2$ when the deflection is quite small as compared to the length of the strip. In Eq. 3 C is flexivity expressed in angular degrees instead of radians.

Deflection constants have also been established by calculations based on deflection-temperature data obtained by experiments on cantilever strips, coils, and other elements of given shapes and dimensions.

Unfortunately, in either case the numerical relations between flexivity and the various empirical constants are affected by the design and mounting of the test specimen as well as the magnitudes of the deflections in some cases. The "constants" are valid only for limited ranges of specimen size and shape and do not provide readily comparable measures of the basic performance of the thermostat metal *per se*. The advantage of the A.S.T.M. method is apparent for within a wide range of dimensions the flexivity, which is a property of the material being tested, is independent of the size of the sample and the thermal response of the test specimen is not hampered by any rigid clamping devices. Now that a standard method has been devised for determining flexivity it is probable that manufacturers' catalog formulas will be revised so that the performance of their thermostat metal will be specified in terms of flexivity and a correction factor based on the shape and dimensions of the particular test specimens preferred.

Design of Devices Depending Upon Thermostat Metal

It has been stated previously that the amount of movement obtained at a free end of a thermostat element is inversely proportional to the thickness of the element, other things being the same. This relation is independent of the shape of the strip and applies to coils, rings, U shapes, and irregular forms.

The deflection is proportional to the square of the length of the strip when small displacements are considered. The length referred to is the distance along the strip from the mounting to the point on the free end of the strip where the deflection is measured. Material extending beyond these points in either direction has no effect on this deflection.

In the foregoing description it has been assumed that the curvature of a strip takes place only lengthwise. Actually the deflection propensity is equal in all directions. When a flat, rectangular strip is heated, it forms a segment of the surface of a sphere. The restrained cross curvature of the clamped end of the cantilever has the effect of increasing the deflection of the free end when small temperature changes are considered. For a constant length, the deflection increases with the width of the strip. The effect of width on deflection is usually small and is a function of the width-length ratio. Approximate calculations are made by assuming the deflection to be independent of the width of the strip.

Although the response of a given thermostat element may be substantially proportional to temperature over a specified temperature range, the relation is not usually exactly linear. Therefore, dials for temperature indicators actuated by thermostat metal should be laid out from actual deflection tests. In general, dial divisions will not be uniformly spaced when large temperature ranges are covered or temperatures below zero are indicated.

An approximate formula for determining the thermal deflection of the free end of a bimetal cantilever can be made by summarizing the preceding relations:

$$y = \frac{KTl^2}{t} \qquad (2)$$

[2] 1940 Supplement to Book of A.S.T.M. Standards, Part I, p. 187.

where:

y = vertical displacement of free end in inches,
K = deflection constant (supplied by manufacturer),
l = length in inches,
T = temperature change in degrees Fahrenheit, and
t = thickness in inches.

The same deflection formula applies to tapered or pointed strips. The effect of width is the same for a tapered strip as for a rectangular element since the width at the clamped base is the determining factor.

The deflection of a U-shaped element having arms of equal length, which are long when compared to the width of the U, is given by the formula below. The deflection is equivalent to two straight pieces half as long as the developed length of the U. The length l is the developed length of the strip.

$$y = \frac{KTl^2}{2t}$$

The deflection of a circular ring is given by the formula below. The length l is the developed length of the strip.

$$y = \frac{KTl^2}{\pi t}$$

The deflection of spiral or helical coils is usually measured in angular degrees rotation. Coils having the low expansion side forming the inner surface close, or reduce in diameter, when heated. The direction of rotation is reversed when the low expansive side forms the outer surface of the coil. The direction of rotation for helical coils also reverses depending on whether the coil is left- or right-hand wound. The deflection direction for spiral coils is reversed merely by turning the coil over. The deflection of both spiral and helical coils can be considered to be the same for coils made from strips of the same dimensions. Using the same notation as before except that d = angular degrees rotation and C = deflection constant supplied by manufacturer, the formula is

$$d = \frac{CTl}{t} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Here again the formula gives only approximate results as the constant C is assumed to be independent of the width of the strip. Actually the constant varies about 15 per cent for extremes in widths.

Deflections of irregular shapes are best determined by test instead of calculation.

Strength:

In selecting an alloy for a thermostat metal not only its expansion rate but also the strength characteristics must be considered. The strength at elevated temperatures is particularly important for high-temperature thermostat metal. In general it is preferable to use combinations which have similar strength properties.

The modulus of elasticity of the different components can vary about 50 per cent without greatly affecting the amount of deflection to be expected from the difference in expansion rates. When the modulus difference is too great the deflection resulting from a change in temperature becomes very small. This is illustrated by such combinations as cadmium-invar and rubber-invar where no ratio of thicknesses will produce deflection with change in temperature.

The torque or pressure developed by a thermostat metal element is easily determined by substituting the thermal deflection for mechanical deflection in standard spring formulas after taking account of the effects of temperature on elastic modulus. The value thus obtained is the force required to prevent deflection of the thermal element.

The amount of work a thermostat element will do may be considered in two ways: First, for a constant load, the work will be a product of the load that can be carried without exceeding the elastic limit and the deflection. The deflection under constant load is the same as the free deflection, the only difference being that the movable end of the element is displaced by the load. Efficiency in this instance is a matter of modulus of elasticity, safe elastic limit, deflection rate or flexivity, and, of course, selecting dimensions which provide an element which will be as highly stressed as is safe.

The second instance covers a variable load and a required deflection, the work being proportional to the pressure change and the deflection. The most efficient element under these conditions is one which utilizes one half of the total deflection for free movement and the other half to develop the pressure change. The amount of work that can be done is proportional to the volume, the modulus of elasticity, and the square of the deflection constant.

Unfortunately deflection and load requirements are usually such that the most efficient thermostat metal element cannot be used. Space limitations are more often the determining factors in thermal element dimensions.

Bond:

Referring again to Fig. 1, it will be recognized that some portions of the bonded area are necessarily highly stressed at elevated temperatures. It is imperative, therefore, that no low melting point or low strength material be used as a bonding agent. A direct fusion weld is to be preferred, or if that is impracticable, the bonding material should have strength characteristics at least as good as the metals being bonded.

Although a considerable amount of written work is available on stresses at the weld line of thermostat metals there is no experimental work to justify the conclusions reached. It should not be possible to develop formulas for calculating stresses at various temperatures without knowing the stress conditions at room temperatures. A metal that is "cold" rolled may actually come off the rolls at 350 F. The difficulty is evident when it is considered that any temperature change modifies the stress condition, and previous effects of welding, hot rolling, annealing, difference in expansion rate, and strength at elevated temperatures may also be unknown factors.

Subsequent "stress-relieving" heat treatments might more accurately be termed "stress-distribution treatments." There is also some question as to the soundness of the elementary statement that the thickness of the components should be inversely proportional to the square roots of the moduli of elasticity.

It is the lack of basic information concerning the mechanical properties, the component alloys of thermostat metal, and the variation of these properties with tempera-

ture that makes it impossible to construct formulas that will accurately predict the performance of a given thermostat element and which makes it necessary to use high safety factors when assigning working stresses for high-temperature service.

Hardness:

Thermostat metal is usually supplied as cold-rolled strip. The cold rolling determines the hardness and the elastic properties of most types. As might be expected, the hardness of opposite sides of the strip is often different. Hardness is frequently a very convenient criterion of the uniformity of the cold-rolling procedures.

In reading hardness, machines using light loads are recommended. The Vickers Brinell, Rockwell Superficial Hardness Tester, and equivalent machines are usually employed. The load and depth of penetration should be no greater and preferably somewhat less than those permissible for single alloys of similar properties that are half as thick as the thermostat metal being tested.

Most types of thermostat metal cannot be hardened by heat treatment. Case carburizing, nitriding, calorizing, or other treatments which modify chemical analysis should be avoided, especially on thin material. Superficial hardness is sometimes obtained by chromium plating. The ends of strips used as tripping members of latch mechanisms can in some instances be slightly hardened by burnishing.

Electrical Resistivity:

The electrical resistivity of thermostat metal can be determined by the same procedure as is used for other strip material. The components can be considered to form parallel paths for current flow. The resistivity of the composite material can therefore be rather accurately calculated from the thickness ratios and resistivities of the components and the over-all dimensions of the specimen. Some error arises from the peculiarities of composition due to diffusion at the weld line, especially when components having a large difference in conductivity are joined.

Commercial Classification

There is no well-defined classification of thermostat metals. The general division is into "low-temperature" and "high-temperature" types. The low-temperature group includes invar in combination with brass or bronze. As would be gathered from the term, this material is used only in applications in which the maximum operating temperature is lower than the temperature at which the physical properties of the non-ferrous alloy components are adversely affected.

The high-temperature metals include all those which can be used at higher temperatures than are recommended for brass or bronze. Into this group fall those materials primarily intended to control at low temperatures but which can be heated to elevated temperatures without suffering changes in physical properties. Accordingly, the group is not limited to combinations in which invar is replaced by an alloy which will provide deflection at elevated temperatures. This is admittedly a loose classification but the terms have grown with the industry and will remain until some concerted action is taken to develop more specific nomenclature.

In the past few years, a group of thermostat metals has been developed for applications in which the element is heated by passing electric current through it. These metals are sometimes referred to as "circuit breaker materials" but no definite term is used by the industry or manufacturers as yet.

Standard Tests as a Basis for Purchase Specifications

Purchase specifications for thermostat metal strip usually include clauses covering flexivity or deflection rate, resistivity, hardness, dimensional tolerances, flatness, and straightness limits, surface appearance, uniformity of bond, and some marking requirement to identify the low or high expansive component. Material used for a specific application may have to conform to some additional requirements such as a bend test or temperature coefficient of resistivity.

Ordinarily chemical analysis is not specified except in a general way as invar and pure nickel, invar and 60–40 brass, etc. The difficulty of obtaining chemical analysis especially on thin strips having more than two laminae precludes the use of this test for routine inspection. The chemical analysis test is usually unnecessary since if resistivity and flexivity are checked satisfactorily the correctness of the chemical analysis may usually be assumed.

The most important property, flexivity, is covered in Method B 106.[2] Test procedures for electrical resistivity and temperature coefficient of resistance as given in the Standard Method of Test for Resistivity of Metallic Materials (B 63 – 36)[3] and the Standard Method of Test for Change of Resistance with Temperature of Metallic Materials for Electrical Heating (B 70 – 39)[4] are recommended for thermostat metals. These methods have been prepared by the Society's Committee B-4 on Electrical-Heating, Electrical-Resistance, and Electric-Furnace Alloys and the committee now has under consideration test methods for hardness, elastic properties, modulus of elasticity, etc.

Several of the large users of thermostat metal have incorporated the A.S.T.M. flexivity test method in their purchasing specifications and there is every indication that this method will come into general use as the basic material test method. Doubtless A.S.T.M. methods for other physical properties of thermostat metals will be adopted by the user as soon as they are available.

The standard methods are a distinct aid to the manufacturer in that they call attention to the variables which can enter into the tests and at the same time provide a common basis for obtaining comparative results. Due to the fact that a composite material is being tested, the measurements are concerned with either the differences in properties of two or more materials or with the combined effect of two or more components. This fact makes thermostat metal more difficult to check than a single alloy of the same general analysis. The manufacturer and the user will both welcome the simplification of purchase specifications by the use of A.S.T.M. standards.

[3] 1939 Book of A.S.T.M. Standards, Part I, p. 713.
[4] *Ibid.*, p. 710.

Development of Methods for the Evaluation of Textile Finishes[1]

By Edwin C. Dreby[2]

THE MARKETABILITY of textiles for clothing, household, and other uses depends in no small degree upon those characteristics of the finish of the goods which are judged by the sense of touch. The importance of the "hand" or "feel" of textiles to manufacturers of finishing agents, to textile finishers, and to distributors of textiles led two years ago to the establishment, under the auspices of the Society's Committee D-13 on Textile Materials, of a research associateship at the National Bureau of Standards for the development of methods for evaluating textile finishes. The accomplishments to date are reviewed briefly in this paper.

The problem was not a simple one, for there are at least eight physical properties of cloth which are appreciated by the sense of touch and which usually are not clearly distinguished from one another in judging hand. They are listed in Table I with a phrase which describes each property qualitatively and with terms which have been selected for use in describing the range of the corresponding components of the hand. This list was prepared jointly by the Special Committee for Testing of Textile Finishes of A.S.T.M. Committee D-13, and the Committee on Crease Resistance and Permanency of Finish on Fabrics of the American Association of Textile Chemists and Colorists (*1*).[3] The words chosen to represent the several physical properties and the corresponding elements of hand were selected to be perhaps the least ambiguous or objectionable of the several that could be used. The purpose of this list is twofold: To arouse a consciously directed effort on the part of textile experts toward analyzing their appreciation of hand into components corresponding to physical properties and to establish a standard vocabulary for describing the hand of all fabrics, thereby clarifying the confusion that exists in this field.

Three of the properties listed—flexibility, surface friction, and compressibility—proved to be the most important characteristics of the soft finished fabrics to which the work was largely devoted. Since the methods already available for evaluating these characteristics of the fabrics were found to be lacking in sensitivity or were tedious and time-consuming, it became necessary to develop new tests. They will be described briefly.

Planoflex

The essential requirement of a flexibility measurement was met by using the Planoflex, shown in Fig. 1, since, as shown later, the results obtained correlate with tactual ratings of "pliability," even though the specimen is not subjected to simple bending. The Planoflex consists of a base plate, mounted on a wooden frame, to which are attached two clamps—one movable, *A*, and the other fixed, *B*—and a hinged shelf. Clamp *A* is constrained by two connecting strips to move in an arc of 6-in. radius in such a way that it is at all times parallel to clamp *B*. A weight clamp, supported by the hinged shelf, is used to put the test specimen under a 2-lb. tension when it is mounted.

A specimen 3 in. wide and 10 in. long, cut with the long dimension parallel to either the warp or the filling yarns of the fabric, is used for the test. One end of the test specimen is fastened centrally in the weight clamp. The other end is fastened in clamp *A* after which the shelf is released, subjecting the specimen to a tension of 2 lb. Clamp *B* is then tightened and the specimen is ready for test. Clamp *A* is moved slowly first to the left and then to the right to the angles at which wrinkles first appear on the surface of the cloth. These angles, in degrees, are read on the scale below the pointer on clamp *A*. The total angle through which the fabric can be distorted in this manner is the sum of the readings obtained on the left and on the right of the center.

The measurement is simple; the instrument is rugged; the large area of specimen used in the test gives very reliable and reproducible results; for most woven fabrics approximately the same angle is observed whether the specimen is cut in the warpwise or fillingwise direction; the instrument is direct reading; and the results obtained indicate the detection of smaller differences than can be appreciated by the hands. Measurements in triplicate, including all operations except conditioning of the specimens, can be made in about 5 min., a factor that is of considerable practical importance.

Friction Meter

The Friction-Meter, shown in Fig. 2, was developed to evaluate the coefficient of kinetic friction between the surface of a fabric and some reference surface. For the purposes of this problem, the coefficient of friction between

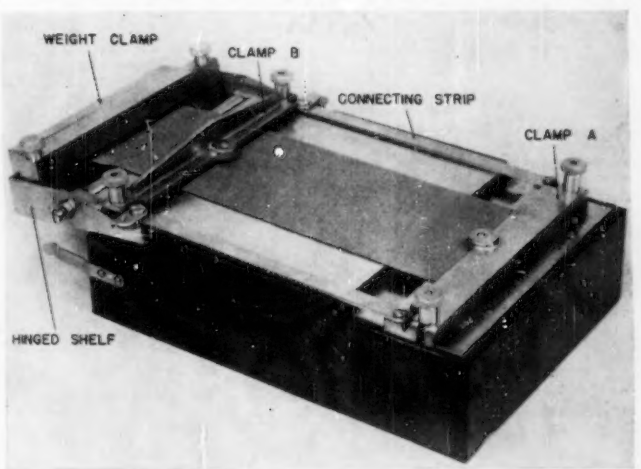

Fig. 1.—Planoflex.

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[1] Presented before Committee D-13 on Textile Materials, A.S.T.M., on October 16, 1941, in New York.

[2] Research Associate for the American Society for Testing Materials at the National Bureau of Standards, Washington, D. C.

[3] The italic numbers in parentheses refer to the reports and papers appearing in the list of references appended to this paper.

TABLE I.—PROPOSED TERMS TO BE USED IN NAMING THE PHYSICAL PROPERTIES OF FABRICS RELATED TO HAND AND FOR DESCRIBING THE CORRESPONDING COMPONENTS OF HAND.

Physical Property	Explanatory Phrase	Terms to Be Used in Describing the Range of the Corresponding Component of Hand
Flexibility	Ease of bending	Pliable (high) to stiff (low)
Compressibility	Ease of squeezing	Soft (high) to hard (low)
Extensibility	Ease of stretching	Stretchy (high) to nonstretchy (low)
Resilience	Ability to recover from deformation in which rate of recovery is without limits and thus includes elasticity (instantaneous recovery)	Springy (high) to limp (low) (Resilience may be flexural, compressional, extensional, or torsional)
Density	Weight per unit volume (based upon A.S.T.M. standard measurement of thickness[a] and weight[b])	Compact (high) to open (low)
Surface Contour	Divergence of the surface from planeness	Rough (high) to smooth (low)
Surface Friction	Resistance to slipping offered by the surface	Harsh (high) to slippery (low)
Thermal Character	Apparent difference in temperature of the fabric and the skin of the observer touching it	Cool (high) to warm (low)

[a] Standard General Methods of Testing Woven Textile Fabrics (D 39 – 39), 1939 Book of A.S.T.M. Standards, Part III, p. 371 (paragraph 5).
[b] *Ibid.*, paragraph 6 (*b*).

two surfaces of the same fabric was found to be satisfactory.

Two specimens approximately 3 1/2 by 10 in., with the long dimension in either the warpwise or fillingwise direction, are used for the test. One specimen is placed face up on the table and one end of it is fastened in a clamp on the drum. The other specimen is placed face down on top of the former and one end is fastened in the clamp on the torsion element. A 1-lb. weight, having an area of 10 sq. in. is put on top of the two specimens. The lower specimen is drawn uniformly from under the upper specimen by turning the crank. The frictional force between the sliding surfaces of the fabric specimens causes a deflection of the torsion element, which is essentially a torsion spring with a 2-in. lever arm. The deflection is indicated on a dial gage, the scale of which is graduated to read the coefficient of kinetic friction directly. At the beginning of the motion a high value is observed, corresponding to the coefficient of static friction, which falls off to a steady value as the motion is continued. The latter value, obtained at a speed of 2.5 ft. per min., is the one recorded.

The measurement is simple, the instrument is so constructed that the torsion element cannot be damaged by an accidental knock, the results are reproducible, and the instrument is sensitive to very small differences and is direct reading. Measurements in duplicate, including all operations except conditioning of the specimens, can be made in about 5 min.

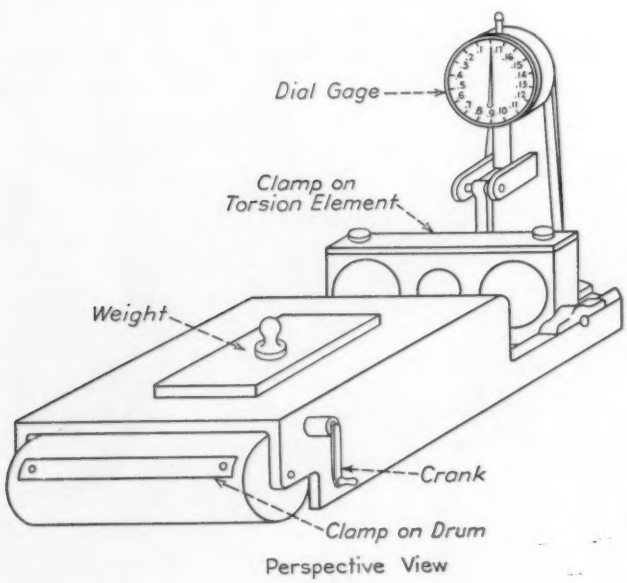

Fig. 2.—Friction-Meter.

Compression-Meter

The Compression-Meter, shown in Fig. 3, was developed to evaluate the compressibility of fabrics. The instrument contains a cavity bounded on the bottom of the instrument by a rubber membrane 3 in. in diameter and approximately 0.004 in. in thickness. The bottom surface of the membrane is flush with the bottom surface of the apparatus. The cavity is filled completely with water. A glass capillary tube 0.1 cm. in internal diameter, the top of which widens into an enlarged space that can be closed with a needle valve, is connected with the cavity. A piston, operated by a graduated screw micrometer, controls the volume of the cavity, thus regulating the liquid level in the capillary tube and the pressure at the membrane surface. When, under the prescribed conditions of use, the liquid level is brought to each of the marks indicated on the capillary tube, the test specimen is subjected to pressures of 0.05, 0.15, 0.25, 0.35, 0.45, and 0.50 psi., respectively. These pressures are produced in part by the weight of the column of liquid and in part by the increase in pressure, over atmospheric pressure, of the air enclosed in the space above the capillary. The Compression-Meter is hinged to a metal base plate which has provision for securing a test

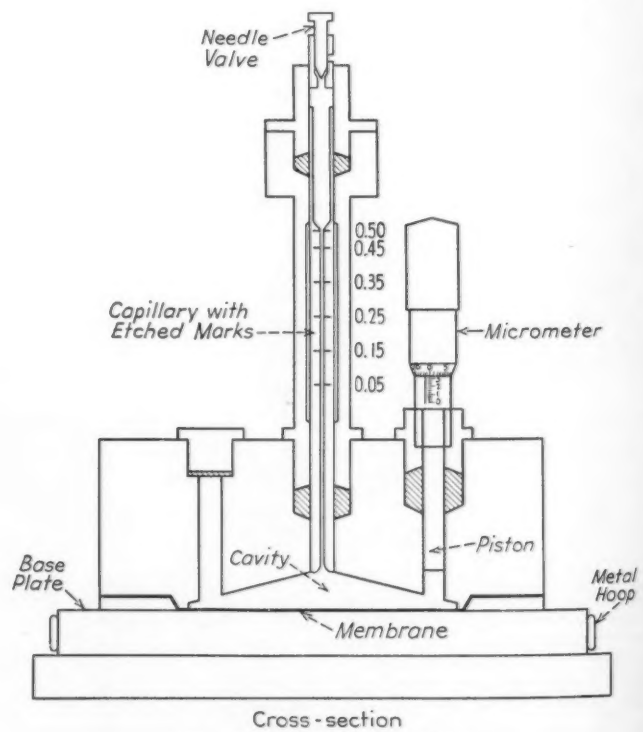

Fig. 3.—Compression-Meter.

specimen over its surface. In use the Compression-Meter is clamped to the base plate by three toggle bolts.

To make a test, a fabric specimen is clamped over the base plate by means of a 4-in. diameter metal hoop. Variations in the tension do not have an appreciable effect upon the measured values. The Compression-Meter is swung into place and clamped over the specimen. Then, with the needle valve open, the liquid level is adjusted to the 0.05-psi. pressure level by turning the micrometer. The needle valve is closed and, again by turning the micrometer, the pressure is increased on the fabric. The micrometer readings in inches at the various pressure levels are observed. The difference in the micrometer readings for a pair of pressure conditions, that is, the micrometer displacement in inches, is proportional to the change in volume of the fabric produced by the change in pressure. This value, when divided by the thickness of the fabric, is proportional to the average compressibility of the fabric for this range of pressure conditions. A similar value for the recovery of the fabric from load, when divided by the value for compressibility under load, can be used for evaluating compressional resilience.

The Compression-Meter, while not so rugged as the other instruments, has two advantages over other devices for evaluating compressibility. It is sensitive at very low pressures. The membrane surface permits a uniform pressure distribution over a large area. Measurements in duplicate, including all operations except conditioning of the specimens, can be made in about 10 min.

Sensitivity of Instruments

The sensitivities of these instruments to small differences in finish were studied by measuring a series of fabrics prepared by treating separate portions of an 80 × 80 cotton fabric with different small amounts of each of three commercial softening agents. The results showed, first, that each of the three instruments measured consistent variations in the properties of these fabrics corresponding to the different amounts of the softening agents applied, secondly, that the differences between the measured results of pairs of fabrics treated with different amounts of the same softening agent were generally greater than the average variation of all observed values from their mean value for any one fabric, and thirdly, that the measured values indicated the differences in the hand of these fabrics as determined by averaging the ratings of hand given independently by four textile experts. These observations indicate the reliability, sensitivity, and significance of the results obtained with the instruments.

Tactual Evaluation

The tactual evaluation of hand is a psychological process involving a mental reaction to stimuli induced by the physical properties of the fabric, coupled with previous experience in handling fabrics. Generally speaking, it is not possible by tactual means, to evaluate one of the fabric's physical properties without being influenced by the effect of other properties. So the three principal tactual qualities of a fabric contributing to its hand, termed by textile experts "pliability," "smoothness," and "fullness," cannot be associated with any one physical property. Pliability of hand is the least complex quality. A flexibility measurement is adequate for its evaluation. Smoothness of hand is quite complex. The more flexible and the more compressible a fabric is, and the lower the coefficient of kinetic friction, the smoother the fabric feels in the hands. Fullness is also complex. The more compressible and at the same time the less flexible a fabric is, the fuller it feels in the hands. It will be observed that the terms "pliability," "smoothness," and "fullness" describe complex qualities of hand and that they should not be confused with the terms in Table I for describing tactual evaluations of individual physical characteristics of a fabric. The results of an extensive study on eighteen 80 × 80 cotton percales will illustrate the significance of the above conclusions.

The relative order of the 18 percales from the most pliable to the stiffest was determined independently by each of eight textile men experienced in handling fabrics of this type. The average of the eight individual relative ratings for each fabric was taken to represent each fabric's relative pliability. In the same way an average relative smoothness rating and an average relative fullness rating were obtained for each fabric. In addition the fabrics were further rated as to their desirability for use as a dress fabric from the standpoint of their over-all characteristics of hand.

Comparison of Tactual and Instrumental Evaluation

In Table II the 18 percales, designated by the letters A to R, inclusive, are arranged in order from the most pliable to the stiffest as determined by their average relative pliability ratings. The results of measurements with the Planoflex are also included in the table. By a statistical method described by Kendall[4] and applied to the evaluation of textile finishes by Schwarz and Winn (*2*), the degree of correlation between the ranking of these fabrics by the tactual and the Planoflex methods of evaluating pliability was determined. The coefficient of correlation obtained (70 per cent) indicated that the Planoflex method gave results that had a highly significant relation to the fabrics' pliability.[4] An examination of Table II shows that fabrics H and L were the ones that differed most in the two series. Two other methods for evaluating pliability, the Schiefer Flexometer method (*3*) and the Peirce Hanging-Heart Loop method (*4*), also indicated the same

[4] According to accepted statistical standards, values of the Kendall correlation coefficient, for the ranking of 18 items, have the following significance: 40 per cent, borderline significance; 47 per cent, significant; 54 per cent, very significant; and above 59 per cent, highly significant.

TABLE II.—DISTORTION ANGLE OF 80 × 80 COTTON PERCALES AND THEIR PLIABILITY OF HAND.

Fabric Designation	Average Relative Pliability Rating	Planoflex Distortion Angle, deg.
A	1.9	12.3
B	3.9	12.0
C	4.1	11.3
D	4.5	10.8
E	4.5	10.5
F	5.4	8.5
G	6.6	10.3
H	8.4	16.8
I	8.9	8.5
J	11.2	6.5
K	11.4	7.0
L	12.4	11.5
M	14.5	4.3
N	15.2	3.0
O	15.5	6.5
P	15.5	3.8
Q	17.6	1.8
R	18.3	4.0

Kendall Correlation Coefficient.....70%
(This coefficient indicates the agreement between the ranking of these fabrics by Planoflex values and their ranking by tactual evaluations of pliability.)

TABLE III.—COEFFICIENT OF KINETIC FRICTION OF 80 × 80 COTTON PERCALES AND THEIR SMOOTHNESS OF HAND.

Fabric Designation	Average Relative Smoothness Rating	Friction-Meter Coefficient of Kinetic Friction
D	3.5	0.49
J	3.7	0.49
N	3.8	0.39
Q	5.0	0.39
O	5.9	0.45
A	6.8	0.53
G	7.1	0.35
C	7.7	0.46
K	8.7	0.42
I	9.4	0.45
P	10.1	0.40
M	11.9	0.43
R	12.9	0.46
L	14.0	0.53
E	14.9	0.50
F	15.5	0.51
H	16.9	0.60
B	17.7	0.55
Kendall Correlation Coefficient		44%

(This coefficient indicates the agreement between the ranking of these fabrics by Friction-Meter values and their ranking by tactual evaluations of smoothness.)

relative displacement of these two fabrics with respect to the others in the series. No explanation has been found to account for the discrepancy between the tactual ranking and the instrumental rankings of these two fabrics.

In Table III the 18 percales are arranged in order from the smoothest to the roughest as determined by their average relative smoothness ratings. The results of their measurement on the Friction-Meter are also included in the table. The Kendall method showed a correlation of borderline significance (44 per cent) between the ranking of the percales by their coefficients of friction and their average relative smoothness ratings. If factors other than the coefficient of friction did not affect the evaluation of smoothness, the correlation coefficient would be higher. Additional studies indicated that the more pliable a fabric, the smoother it felt and the more compressible a fabric, the smoother it felt. Both of these characteristics permit the fabric to conform more readily to the contour of the fingers as the fabric is drawn through them, and they seem to reduce pressure stimuli that give a feeling of roughness. No precise method of evaluating their relative effects on smoothness has been developed, however. While such a method would be highly desirable, the lack of one does not prevent the over-all evaluation of hand, as shown later.

In Table IV the 18 percales are arranged in order from the fullest to the least full as determined by their average relative fullness ratings. The results of their measurement with the Compression-Meter and their thickness,

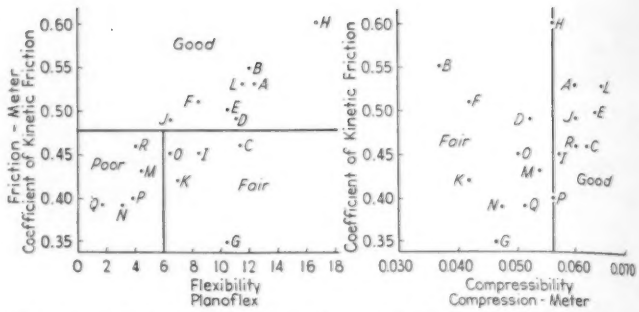

Fig. 4.—Relation of Hand to Measured Properties of 80 X 80 Cotton Percales.

measured under a pressure of 1 psi. are also included. The Compression-Meter value, which is the micrometer displacement in inches, when divided by the thickness, gives a quantity proportional to the compressibility of the specimen. These quantities are not given in the table, since the Compression-Meter value itself, a function of both compressibility and thickness, is more useful in evaluating hand. The Kendall method showed a lack of correlation (12 per cent) between Compression-Meter values and average relative fullness ratings. The Compression-Meter value did indicate, however, a characteristic appreciated by the hands, namely, "thinness" or "thickness" of hand. This characteristic is not to be confused with the physical dimensions of the fabric, for, as the results in the figure show, the impression of "thickness" is not related so much to the physical thickness of the specimen as it is to its compressional characteristics. The explanation seems to be that a compressible fabric piles up against the fingers as it is drawn through them and creates the impression of "thickness." The compressional characteristics, which in themselves showed no correlation with fullness, were not without effect, however, on the fullness of hand. The Compression-Meter values when divided by the respective Planoflex values gave quantities that were highly significantly related (Kendall correlation coefficient of 76 per cent) to the average relative fullness ratings. Thus the more compressible, the thicker, and at the same time the less flexible a fabric, the fuller it will feel in the hands.

Over-All Evaluation of Dress Fabrics

The foregoing illustrates how certain physical properties of a fabric affect its components of hand. In practice,

TABLE IV.—COMPRESSION-METER VALUES OF 80 × 80 COTTON PERCALES AND THEIR FULLNESS OF HAND.

Fabric Designation	Average Relative Fullness Rating	Thinness of Hand	Compression-Meter Value,[a] in.	Thickness, in.	Planoflex Distortion Angle, deg.	Compression-Meter Value Divided by Planoflex Value
R	3.1	..	0.061	0.0078	4.0	0.0153
P	5.0	..	0.057	0.0074	3.8	0.0150
N	5.1	thin	0.048	0.0070	3.0	0.0160
O	5.2	thin	0.050	0.0076	6.5	0.0070
Q	5.5	thin	0.052	0.0064	1.8	0.0289
J	7.7	..	0.061	0.0075	6.5	0.0094
M	8.7	thin	0.054	0.0075	4.3	0.0126
I	10.4	..	0.058	0.0081	8.5	0.0068
L	10.4	..	0.066	0.0076	11.5	0.0057
K	10.6	thin	0.042	0.0082	7.0	0.0060
D	11.2	thin	0.053	0.0078	10.8	0.0049
G	11.4	thin	0.047	0.0077	10.3	0.0046
E	12.2	..	0.065	0.0090	10.5	0.0062
C	12.9	..	0.063	0.0083	11.3	0.0056
A	13.1	..	0.061	0.0081	12.3	0.0050
F	14.5	thin	0.042	0.0073	8.5	0.0049
H	14.9	thin	0.057	0.0080	16.8	0.0034
B	16.3	..	0.037	0.0072	12.0	0.0031
Kendall Correlation Coefficient			12%		66%	76%

(This coefficient indicates the agreement between the ranking of these fabrics by several measured quantities and their ranking by tactual evaluations of fullness.)

[a] The Compression-Meter values listed are the micrometer displacements, in inches, necessary to change the pressure on the fabric from 0.05 to 0.45 psi.

however, it is the over-all effect in the hand that determines the fabric's desirability, and while one fabric may have characteristics that make it very desirable for one purpose, the same characteristics may make it very undesirable for another. The 18 percales were rated for desirability as dress fabrics. They were classified as good, fair, and poor. In Fig. 4 the Planoflex, Friction-Meter, and Compression-Meter data are plotted to show the distribution of values and their relationship to desirability of hand. It was found that the graph could be divided into certain regions associated with different degrees of desirability. Thus, all the percales having a Planoflex value greater than 6.0, a Friction-Meter value greater than 0.48, and a Compression-Meter value greater than 0.057 had a good hand for use as a dress fabric. From this it is seen that irrespective of the way the measured properties affect separate components of hand, the three measurements together enable the quantitative specification of the hand of a fabric.

Uses of the Instruments

Further investigations that have substantiated the usefulness of the Planoflex, Friction-Meter, and Compression-Meter for the evaluation of hand were made on a wide variety of fabrics. These included cotton print cloths, broadcloths, poplins, organdies, twills, and sateens; rayon french crepes, twills, satins, and spun rayon fabrics both of a linen-like and a challis-like finish; wool and mixed wool-rayon uniform suitings and shirtings; warp-knit rayon dress fabrics; and silk hosiery. It was indicated by these studies that all fabrics in which hand is an important characteristic can be measured satisfactorily with the Friction-Meter and Compression-Meter. Knit fabrics, because they are too easily stretched, and heavily sized fabrics, because their warp and filling yarns are cemented together, cannot be satisfactorily measured with the Planoflex. For such fabrics, the results of other methods for evaluating pliability, such as the Schiefer Flexometer method (3) or the Peirce Hanging-Heart Loop method (4), can be used in the same manner as Planoflex results for evaluating and specifying their hand.

Each of the three instruments is limited in its use in that results are only comparable on similarly constructed fabrics. This is not a serious limitation, since hand itself is relative and for the most part only similarly constructed fabrics are compared.

In addition to the use of the Planoflex, Friction-Meter, and Compression-Meter for evaluating quantitatively the hand of fabrics, their sensitivity and practicability make them particularly adaptable to numerous other problems. These include the evaluation of the effectiveness of different finishing agents, whether they induce softness, surface lubrication, body, or crease-resistance; the evaluation of the effectiveness of different, mechanical-finishing treatments such as calendering and drying; control of finishing processes; the effect of laundering on regular-finished and semipermanent-finished fabrics; and the effect of fiber composition on the characteristics of the hand of fabrics.

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XXV. Long-Time Society Committee Members

Twenty-fifth in the Series of Notes on Long-Time Members

Editor's Note.—After a lapse of several issues we renew this series of articles giving notes on the important activities of long-time A.S.T.M. members. Begun in 1934, the series has presented outlines of the work of more than 70 men who in general have been affiliated with the Society for 25 years or more and have taken part in committee work for long periods of time. These articles have been received with much interest by many in the Society. Frequently a member's committee associates know very little of his personal background or activities and some of these are very interesting indeed.

H. S. Mattimore, Engineer of Materials and Tests, Pennsylvania Department of Highways, Harrisburg, Pa., received his education in Albany, N. Y., his native city. His early industrial practice was on geological surveys and highway construction in New York State. Beginning in 1910 through 1919, he was in charge of testing and materials investigation for the New York State Highway Department. Following this he was appointed to his present position with the Pennsylvania Department of Highways. In these capacities he has been concerned with many interesting developments in the highway field and has contributed in no small measure to technologic progress in testing and research in highway and construction materials.

He has been affiliated personally with A.S.T.M. since 1914 and has served the Society in many important capacities. He has been a member of Committees A-3 on Cast Iron and A-5 on Corrosion of Iron and Steel for fifteen years and his service in other groups is considerably longer, including C-9 in Concrete and Concrete Aggregates from 1918 and several of its subcommittees; C-1 on Cement since 1926, where he is active in various phases

W. E. Carson W. M. Kinney H. S. Mattimore

of the work and formerly served as chairman of one of its subcommittees; and Committee D-4 on Road and Paving Materials since 1916, where his interest perhaps has been most pronounced. A member of numerous subcommittees, he served as chairman of Committee D-4 from 1924 to 1926. He is a member of Committees C-13 on Concrete Pipe and D-18 on Soils for Engineering Purposes, and of three of the latter's subcommittees. He was a member of the Society's Executive Committee from 1928 to 1930, and rendered important service as a member of Committee E-10 on Standards from 1935 until his term expired last year. He is concerned with work of sectional committees functioning under A.S.A. procedure.

From the above notes it can be seen that Mr. Mattimore is extremely active in many phases of A.S.T.M. work, yet he is also a member and active on committees of the American Society of Civil Engineers, American Association of State Highway Officials, Highway Research Board and the National Society of Professional Engineers. A number of his important technical contributions have been published in the A.S.T.M. *Proceedings* pertaining particularly to the field of concrete and concrete aggregates.

W. E. Carson, President and General Manager, Riverton Lime and Stone Co., Inc., Riverton, Va., is one of our members whose numerous activities outside A.S.T.M. should be of keen interest to a large number of members, and is one to whom many members are indebted for travels and sojourns they may have had in Virginia, for one of the very notable activities in which Mr. Carson was a leader involved the establishment of Shenandoah National Park and of the new state park system in Virginia. Much of his work in establishing Shenandoah National Park and the Colonial National Historical Park (Jamestown, Williamsburg, and Yorktown) occurred while he was chairman of the Virginia Conservation Commission from 1926 to 1934. For twelve years, beginning in 1908, he was President of the National Lime Association and during the last war was Chairman of the War Service Committee on Lime functioning under the War Industries Board.

Affiliated with the Society continuously since 1912, connection of his company (now a sustaining member) dating from 1920, Mr. Carson has been concerned particularly with the work of Committee C-7 on Lime on which he has rendered service in numerous capacities, and is at present vice-chairman and heads the subcommittee on hydraulic lime. He was the former chairman of the subcommittee on definitions and has for over twelve years been a member of Committee C-1 on Cement. He also has rendered service on Committee C-12 on Mortars for Unit Masonry and several of its subcommittees.

In addition to the services indicated above, Mr. Carson served his state in organizing the State Forestry and Geological Departments and in connection with the establishment of water power laws; he was largely responsible for the U. S. Remount Depot at Front Royal, and to this town he presented a Recreational Park. For his work he has received numerous honors including a medal from the American Scenic and Historic Preservation Society of New York; the Parchment of Distinction from the New York Southern Society; and was commended publicly by former Governor John Garland Pollard of Virginia and by Herbert Hoover when President. Recent honors include election as Honorary Member of the Sons of the American Revolution and erection of a marker by the Virginia Conservation Commission to Mr. Carson as its first chairman, the marker being placed temporarily near the Northern entrance to the Skyline Drive at Front Royal.

William Morton Kinney, Vice-President and General Manager, Portland Cement Assn., Chicago, Ill. A reference to *Who's Who in America* or *Who's Who in Engineering* will indicate that Mr. Kinney is a native of Chicago, that his preparatory education was obtained in John Marshall High School, and that he received his degree of Mechanical Engineer from Lewis Institute, which degree if received two years earlier would have placed him in the same class with at least one other A.S.T.M. member—Past-President H. H. Morgan. He began his industrial life in 1906 as a draftsman, and in 1907 he was employed by the Universal Portland Cement Co. in Pittsburgh. He served as Engineer in the Promotion Bureau of this company from 1914 to 1918. His long-time service with the Portland Cement Association began in 1918 when he was appointed General Manager. He has also been Vice-President since 1930.

Mr. Kinney is one of a group of several long-time members whose work has been reviewed in this series of articles, and of a much larger group, whose activities in A.S.T.M. are confined largely to one specific field, but nevertheless have been very significant and helpful in advancing the respective phases of A.S.T.M. work. Much of the outstanding work in standardization and research in the field of portland cement has been under A.S.T.M. auspices and all of it has received the close support of Mr. Kinney and many of his technical and engineering associates at the P.C.A. Research Laboratory. He has served continuously on Committee C-1 on Cement since 1915 and has been a member of its subcommittees. He was also a member of Committee C-9 on Concrete and Concrete Aggregates from 1914 through 1923.

In addition to his membership in A.S.T.M., he is also affiliated with the Western Society of Engineers, American Road Builders' Association, and the American Society of Civil Engineers. His clubs include the Chicago Athletic Association, Skokie Country Club, and the Kenilworth Club in which community he resides.

Heating and Ventilating Engineers Program

Recently issued by the American Society of Heating and Ventilating Engineers through its Committee on Research is a 48-page booklet entitled "Programs of the Research Technical Advisory Committees of the American Society of Heating and Ventilating Engineers." This booklet contains the personnel of each committee, a briefly stated scope of activity, an outline of planned research investigations, available laboratory facilities, a list of publications emanating from each committee program, and typical illustrations showing equipment in the several research laboratories. A bibliography of research reports is also included. A limited number of copies of the booklet are available on request from the American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York, N. Y.

Protection of Personnel Handling Radium[1]

By L. F. Curtiss[2]

In recent years there has been a rapid increase in the use of radium in the radiographing of heavy castings and other metal parts. This development has resulted not only from the great penetrating power of gamma rays from radium, but also from the quality of the radiographs which can be produced by this means. It is to be anticipated that this increase in the use of radium for the purpose will continue, bringing with it certain problems in the protection of the personnel doing this type of work. The main object of this paper is to describe an exposure meter which may be of help in reducing hazards in this work.

The relatively large individual preparations used, ranging from 50 to 500 mg. of radium element, must be handled with special caution to avoid injuries. All the general precautions to be observed in the handling of radium must be applied very strictly to the handling of these preparations and additional safeguards provided for the particular hazards here involved. No one who is ignorant of these hazards or careless in following safe procedures should be permitted to carry out radiographic tests using radium. A thorough consciousness of the presence of the radiation and its ability to inflict injury must be developed in the mind of the personnel. Only in this way can rules of safe procedure be made effective and the individual protected from harm.

The protection of individuals from radium involves two more or less distinct but related problems. Injuries may be produced in one of two ways. There may be local injuries due to overexposure of a part of the body, as the fingers, to a radium preparation at a short distance. This type of injury is sometimes described as a "radium burn." These burns were all too common in the early days of the industry. However, they are inexcusable in the light of present knowledge. The second type of injury is that produced by a general exposure of the whole body to gamma radiation from radium preparations that may be at some distance. This type of exposure is somewhat more difficult to detect and control, since the damage is done at a greater distance and the individual is less aware of the danger. In addition, the deleterious effects are much slower in becoming evident, requiring months and even years, whereas burns may become evident in days or weeks. In both cases there is no discomfort or apparent injury at the time of exposure so that the worker may be severely affected without being aware of any injury. The delayed action of radiation from radium on tissues of the human body makes it necessary to develop rules and arrange equipment so that the personnel, in carrying out the work, will automatically proceed in a way that will involve no exposure beyond that which is now regarded as safe.

In devising safe methods of handling radium the most important consideration is to take advantage of the decrease of intensity of this radiation with distance. Since the radiation decreases as the square of the distance, safe conditions are readily provided if the radium can be kept at a sufficient distance. This is illustrated in the accompanying Fig. 1. This factor should receive special consideration in connection with the storage of radium. The storage vault should always be placed as far as possible from any location regularly occupied by individuals. Even in the actual manipulation of the radium, the safety can be greatly increased by long-handled forceps, remote controls, and other arrangements which permit the operator to be as far as possible from the radium. The actual form of the devices to achieve this end must depend on the requirements of the operation to be performed. In the simplest cases a piece of fish line attached to a holder for the radium or a long wooden handle provided with a hook at the end to engage an eye in the holder may offer a convenient means of placing a reasonable distance between the radium and the technician. Special forceps or tweezers are also available which are sufficiently long to provide

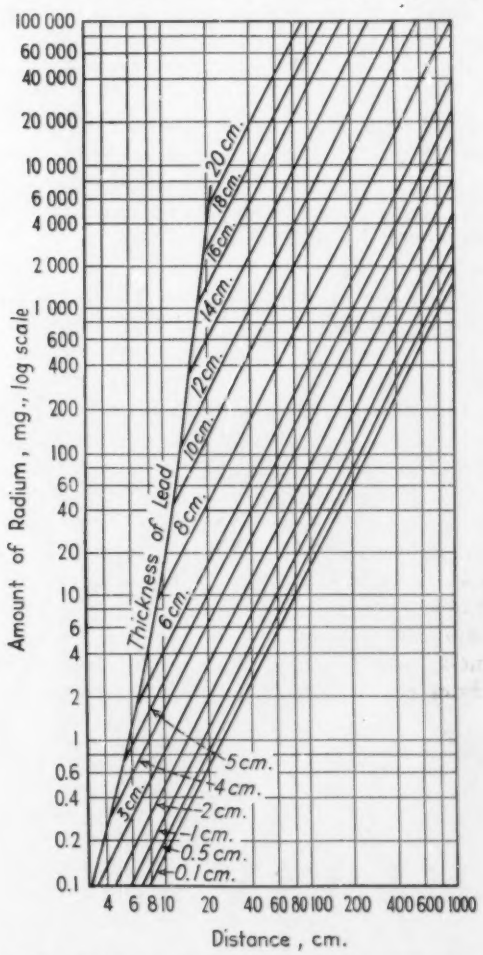


Fig. 1.—Safe Working Distances for Various Amounts of Radium Screened by Various Thicknesses of Lead. Based on a Tolerance Dosage of 0.1 roentgen per 8-hr. day.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

[1] Presented at meeting of Committee E-7 on Radiographic Testing, June 23, 1941.

[2] Research Physicist, National Bureau of Standards, Washington, D. C.

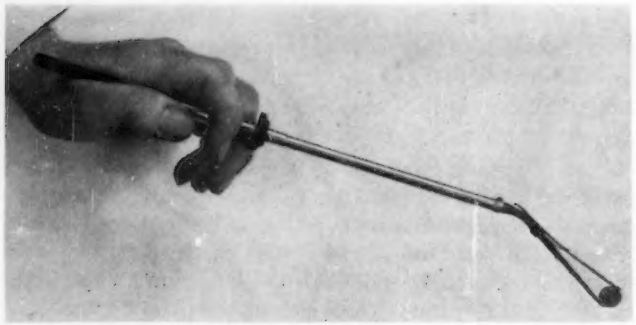


Fig. 2.—Long-Handled Light Forceps for Handling Large Preparations of Radium.

considerable protection. One form is shown in Fig. 2. These forceps are very light yet permit a distance of 12 to 14 in. between the radium preparation and the hand. They are self-closing, so that the operator is not required to press them to hold the preparations. A finger trigger is provided for opening the forceps to pick up and to release the radium.

Another important factor is the time of exposure. Certain operations and manipulations involve temporary general exposures in excess of that generally regarded as safe. Therefore they must be made of as short a duration as possible. Accessories, such as long-handled forceps, will prevent the possibility of radium burns, but the general dosage of the whole body must be reduced by convenient arrangements, so that these operations can be carried out quickly. All equipment should be carefully designed with this factor in view. Many details contribute to the speed with which radium can be transferred from one position to another. For example, identifying numbers should be engraved on metal capsules containing radium and these numbers should be large enough to be read clearly at a distance of several feet.

Methodical arrangements for storage should be provided in the vault so that each preparation is assigned a definite compartment, identified by letters or numbers. This enables the operator to locate and remove the desired preparation with a minimum of exposure.

There are many situations in which distance alone cannot provide the full protection that is required or desirable. These conditions require the use of screens and shields of heavy metal such as iron, brass, or lead. Operations requiring the transfer of radium preparations from one container to another should be carried out behind L-blocks of lead or iron, 3 to 4 in. in thickness. It is desirable that these metal blocks be covered entirely with a layer of wood or similar light material, an inch or so in thickness, to cut down the soft secondary radiation emitted from the metal block under the influence of the gamma rays. This secondary radiation is readily absorbed in the skin and continued exposure may result in injuries, such as burns.

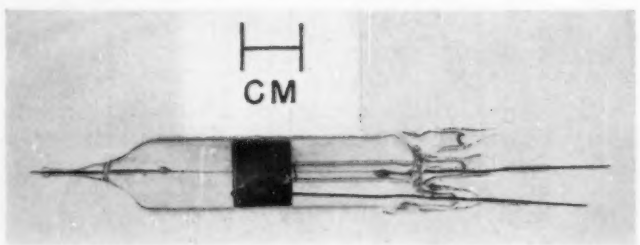


Fig. 3.—Small Geiger-Müller Tube Counter Used in Exposure Meter.

Detailed rules for handling radium are set forth in a handbook, H23, on radium protection, published by the National Bureau of Standards. This handbook contains the chart (Fig. 1) showing safe distances for various amounts of radium when different thicknesses of lead screens are used. The chart is based on a tolerance dose of 0.1 roentgen per 8-hr. day, which is regarded as safe. Technicians engaged in radiography by the use of radium should be familiar with the contents of this handbook.

It should be emphasized that it cannot be assumed that once safe conditions have been established they will remain safe. The shifting of radium from one place to another, sometimes required in radiography, creates new conditions. If additional radium is brought in, a revision of the original arrangements may be necessary to insure safe conditions. The ease with which radium may be moved about, which contributes greatly to its usefulness, also complicates the problem of protecting technicians. Constant care and supervision are required to keep exposure down to a safe level. This makes it desirable to have some type of instrument sensitive to gamma radiation and which is calibrated in roentgens per day to detect changes in exposure. Such a device is useful not only in exploring a given set of conditions but also to reveal changes that may occur from time to time. The author has developed a type of Geiger-Müller counter which has proved very successful in meeting this need. It has also been useful in training technicians to become conscious of radiation and to alter their procedures to conform to requirements for safety.

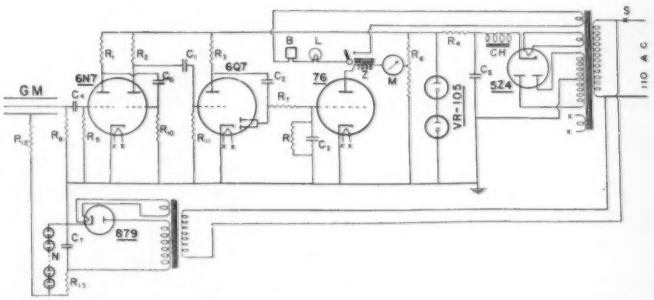


Fig. 4.—Wiring Diagram of Experimental Exposure Meter.

The sensitive element of this exposure meter is a small Geiger-Müller tube counter 1 cm. in diameter and 1 cm. long, shown in Fig. 3. It is sealed in a Pyrex glass tube, which serves as a container for the gas used as a filling medium. The counter tube is thus a glass bulb permanently sealed, which will retain the gas at constant pressure over long periods. The gas used to fill this bulb is a mixture of argon and alcohol vapor. This mixture has remarkable properties in connection with the operation of the counter tube. The argon permits the tube to be operated at relatively low voltages—below 1000 v.—and the alcohol vapor renders the counter tube self-quenching. The counter tube functions by releasing an electrical discharge between the central wire and the surrounding metal cylinder, which generates an electrical pulse. The measurement of intensity consists in some method of determining the rate at which the radiation produces these pulses.

One of the most convenient methods for determining this rate consists in amplifying and equalizing the pulses, after which they are rectified and permitted to accumulate in a condenser. The condenser is provided with a resistor across the terminals. Under these conditions the potential across the terminals of the condenser is a measure of the counting rate. This potential may be measured with a vacuum tube voltmeter, which may be incorporated in the electrical circuit with the milliammeter of the voltmeter stage, arranged to indicate the counting rate. This meter may be calibrated either in terms of counts per minute or directly in terms of micrograms of radium at a given distance. When the instrument is used as an exposure meter it may be calibrated in roentgens per day.

An electrical circuit suitable for this purpose is shown in Fig. 4. It is designed to operate directly from the 110-v. a-c. supply. The direct currents required in the circuit are provided by rectification and stabilization. The voltage for the amplifier tubes is stabilized by the two VR-105 tubes in series, and the voltage for the tube counters, *GM*, is stabilized by the neon lamp bank, *N*.

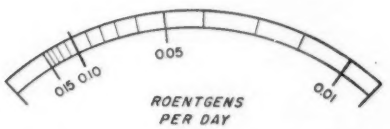


Fig. 5.—Scale of Indicating Meter.

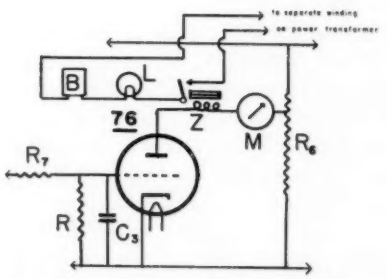


Fig. 6.—Details of Warning Circuit to Indicate Excessive Exposures.

With this arrangement these voltages are for practical purposes independent of the a-c. supply voltages for any fluctuations likely to be encountered. Therefore the circuit may be operated directly from an ordinary 110-v. a-c. outlet.

Three vacuum tubes are used to determine the rate of pulses in the counter. The first tube, 6N7, is a dual triode. The two triode units amplify the pulses and deliver them as negative pulses through the condenser *C* to the triode unit of the next tube, 6Q7. This triode unit is operated at zero grid bias so that the negative pulses applied to the grid throw the steady plate current completely to zero for each pulse. The two stages of the 6N7 give sufficient amplification so that even the weakest pulses from the counter tube are sufficient to cut the plate current in the triode stage of the 6Q7 to zero. Therefore, all pulses passed by this stage of the 6Q7 are of equal size. These equalized pulses are passed through condenser C_2 and rectified by the diode section of the 6Q7, so that a small definite negative charge is passed through resistor R_7 for each pulse. These charges accumulate in condenser C_3

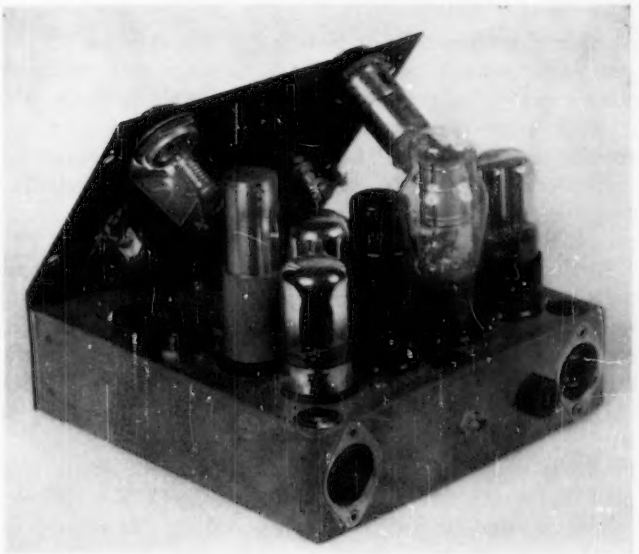


Fig. 7.—Interior View of Commercial Exposure Meter.

charging the terminal attached to the grid of the next tube, 76, negatively. Condenser C_3 is provided with a resistor *R* across its terminals so that the charge leaks off the condenser at a steady rate. Therefore, for a constant rate of pulses, the negative potential across condenser C_3 gradually arrives at a steady value. This negative potential applied to the grid of the 76 tube reduces its plate current to a correspondingly steady value and milliammeter *M* in the plate circuit of this tube gives a steady reading which is proportional to the rate of pulses in the counter tube.

It is to be noted that no bias voltages, sometimes troublesome to adjust and maintain constant, are used.

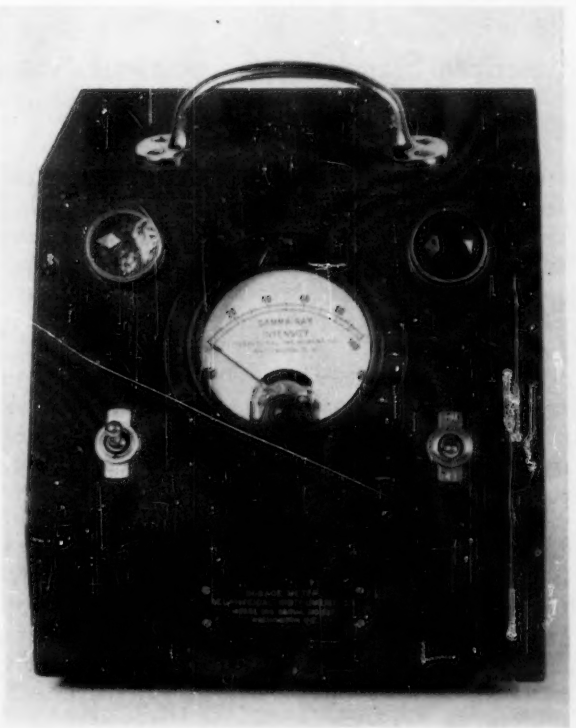


Fig. 8.—Exterior View of Commercial Instrument.

Also, multivibrators have been avoided. This reduces considerably the difficulties in adjusting the circuit and securing constant performance. Another advantage of the circuit is that no quenching stage for the counter tube is used, since the alcohol vapor counter tube does not require such a stage. The simplicity of the amplifier results in a satisfactory and uniform performance. No periodic readjustments of any kind are required to maintain this performance.

Milliammeter *M* may be calibrated directly in roentgens per day. Since the plate current in the 76 tube decreases with increase of counting rate, this meter reads backward, the higher the counting rate the lower the reading of the milliammeter. A sample scale is shown in Fig. 5. With the instrument calibrated in this way, it can be set up at any point where the amount of exposure is to be determined in terms of roentgens per day and the meter will give this value directly. It will also show any changes in the exposure as the result of changes in the amount or location of radium in the neighborhood.

It was considered desirable to include in this circuit a device to give warning when the tolerance limit of 0.1 roentgen per day is reached. Figure 6 shows the portion of the circuit containing the meter and 76 tube to indicate the method by which this has been accomplished. A relay *Z* is placed in series with meter *M* in the plate circuit of the 76 tube. This relay is adjusted to close when the reading of *M* is 0.1 roentgen per day. Lamp L and buzzer *B* are placed in the contact circuit of the relay. This circuit is energized by a separate low-voltage winding on the power transformer. When the tolerance limit is reached, the buzzer and light are energized, giving both a visible and audible warning of the approach to unsafe conditions.

Two views of a condensed model of the instrument designed for commercial use are shown in Figs. 7 and 8. Considerable reduction in size and weight has been made in this model, as compared with the experimental instrument described above, with several improvements to increase reliability of operation. An instrument of this type has been in continuous use in the Radium Laboratory of the National Bureau of Standards for over a year, with very satisfactory results. It has been found very helpful in training technicians to become conscious of the presence of radiation. It provides a continuous check on the exposure under rapidly changing conditions. In this way it makes relatively simple the problem of supervision to maintain safe conditions of exposure. Better control can be obtained by its use than could be obtained by a complete daily inspection of the amounts and locations of radium in use or in storage. In practice, such inspections are rarely made with sufficient regularity to be of great value as a means of protection.

This instrument may also be used to survey the intensities of gamma radiation in the neighborhood of a radiographic assembly, to determine the regions where personnel may work continuously with safety. The boundaries of the regions of safety can be determined in this way for each new set of conditions. This procedure produces confidence on the part of the technicians and personnel in the vicinity. It also eliminates much waste of time in arranging protective measures which may not be necessary.

A word of warning should be given that this instrument cannot be expected to retain its calibration indefinitely. It is therefore desirable that a small standardized preparation of radium of the order of from 0.1 to 1 mg. be available for occasional check of the indication of the meter. For practical purposes a preparation of 1 mg. of radium in 0.3 mm. of platinum will yield a tolerance dosage of 0.1 roentgens per 8-hr. day at a distance of 28 cm. from the center of the Geiger-Müller tube counter.

American Standards Association Annual Meeting

At the annual luncheon meeting of the American Standards Association held in New York on December 10 some 300 representatives of the groups holding membership in the Association heard interesting discussions of the work accomplished and programs contemplated and also had first-hand information on the work of the OPM Bureau of Industrial Conservation in the address by J. Lessing Rosenwald, head of this Bureau.

A.S.T.M. has been vitally interested in the work of the Association and is one of the five founder bodies. R. E. Zimmerman, A.S.A. president, mentioned that during the year five new national organizations had become affiliated with A.S.A., bringing to 77 the national organizations represented, and a large number of individuals and companies are also affiliated. R. P. Anderson, Chairman of the Standards Council briefly reviewed the technical activities and progress of the Association during the year.

As a federation of technical trade and government groups, the A.S.A. has an important coordinating function and its approval of specifications and standards developed by various bodies gives them national recognition as American Standard. To date, more than 150 A.S.T.M. standards have been approved by the A.S.A., this figure representing more than 50 per cent of those accorded A.S.A. approval. In addition to materials specifications and dimensional standards one of the most important functions of the A.S.A. is the development through sectional committees and in other ways of safety standards. The Association also has important projects under way in building and plumbing code work and in the field of photography. Early in the year there was approved a short-cut emergency method of developing needed defense standards and four have already been issued, one covering accuracy of engine lathes; another establishes safe limits for cadmium; and two others cover quality control in mass production.

International contacts in standardization work are a function of the Association. Currently problems of Inter-American cooperation are most important and contacts already established are to be developed further.

Many members of the A.S.T.M. are active in sectional committee work and in other A.S.A. activities. Aside from the material specifications, A.S.T.M. members should undoubtedly find of interest many of the standards approved by the A.S.A., and copy of such a list will be gladly sent on request to the offices, 29 West 39th St., New York, N. Y.

Shear Strength of Molded Plastic Materials*

By John Delmonte[1]

SYNOPSIS

The punch and die are described in the measurement of shear strength upon molded plastic parts as a useful tool for a rapid method of evaluating this property by molders. Test results upon phenolics and ureas which have been cured for different periods of time are described. It is pointed out that differences in shear values of molded phenolics are augmented by several minutes immersion in acetone, whereas boiling water may be used to reveal substantial variation in the cure of molded urea parts and their shear strength. Comparative tests upon a large number of injection molded pieces produced in the same mold are outlined, and a table prepared comparing these materials with respect to shear strength. Injection moldings of polyvinyl chloride-acetate and polymethyl methacrylate proved to be the highest. Further tests designed to show the utility of the punch and die reveal data on the shear strength of molded plastics as function of temperatures from 0 to 300 F.

THE DETERMINATION of the shear strength of plastic materials affords a simple and rapid method of comparing an important physical property of these materials. With a standard punch and die as described in this paper, tests are performed in a few seconds, which are quite accurate when performed with the proper load-measuring equipment. It was one of the purposes of this investigation to develop a technique which would enable molders to determine the physical quality of their molded samples on short notice, without the time required for more conventional compression and tension tests. It was also a further purpose of this test to compare the shear strength of injection-molding compositions molded under identical conditions.

The conventional method of testing shear strength of plastics is to place a flat specimen in a universal testing machine between a pair of shear blocks and gradually apply load until failure occurs. This method has much to recommend it for comparison of sheet stocks of plastic materials. However, as far as molded materials are concerned, methods designed to test materials exactly as they are molded, in the same type of mold as they may be used in production, have considerable merit. Not only are the effects of flow, which so decidedly have a bearing upon physical properties, accounted for, but tests are also conducted rapidly, which of course would interest the molder.

Analysis of a punch and die operating upon a plastic material shows that shear stresses are substantially developed upon the stock. The sheared-out specimens, shaped in this test, are perfectly round cylinders.

Equipment Used

Determination of the shear strength of the various materials reported in this paper was made with the aid of a circular, hardened steel punch and die which measured 0.106 in. in diameter. The punch was forced through a flat portion of the sample of material being tested, and the loads measured with the aid of a spring loaded scale. The scale was calibrated before tests with dead weight and found to be accurate to within 1 lb. The scale was divided into 1-lb. divisions, measuring up to 250 lb.

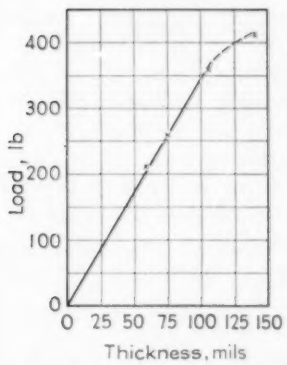


Fig. 1.—Calibration Test on Polymethyl Methacrylate
Diameter of punch—0.106 in.

In conducting tests, loads were applied at a rate designed to produce failure within 3 to 5 sec. Preliminary investigations using the punch and die showed very little effect of time of loading up to 1 min. on the final reading. Shear strength was estimated from the following formula:

$$\text{Shear Strength} = \frac{\text{Load required to force punch through specimen}}{\pi \times 0.106 \text{ in.} \times t}$$

where t = thickness of test specimen where shear occurred.

Calibration of the punch for different thicknesses is represented in Fig. 1, using as a test specimen a 1/4-in. sheet of polymethyl methacrylate sheet. Different thicknesses were milled out of this sheet and the load required to produce failure is shown as a straight-line function of thickness, up to the diameter of the punch.

The punch and die were hardened, and the punch was rotated in the bearing which served to align it with respect to the die until a smooth fit was obtained by applying a fine lapping compound between the punch and die. Actual measurement on the punch was 0.1053 in., and the die 0.1085 in.

Test Results

Various phenolic and urea molding compositions were tested under varying pressures, temperatures, and times of cure. Two representative curves are shown in Figs. 2 and 3. For the as-molded condition, samples were tested 24 hr. after being molded. As would be expected, shear strength continues to increase with time of cure. An even greater differential of shear strength as a function of cure may be performed upon the same specimens after

* Presented at the Forty-fourth Annual Meeting, Am. Soc. Testing Mats., Chicago, Ill., June 23-27, 1941.

[1] Technical Director, Plastics Industries Technical Institute, Los Angeles, Calif.

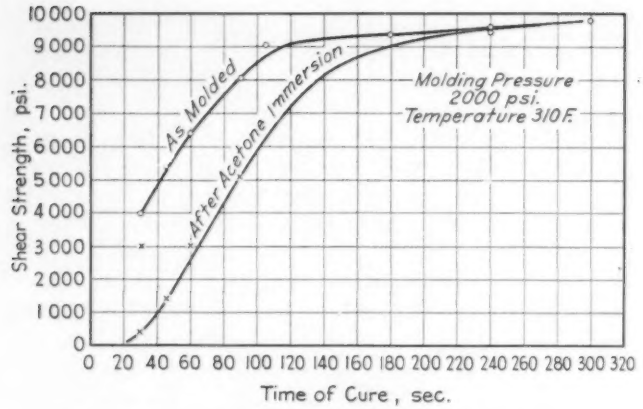


Fig. 2.—Shear Strength as Function of Time Cure.

Phenolic molding material—Durez No. 1898. Average thickness—0.068 in.

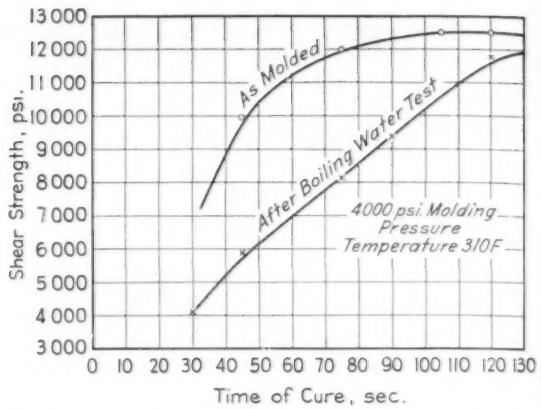


Fig. 3.—Shear Strength as Function of Time of Cure.

Urea molding material—Plaskon No. 892, SMG.

they have been immersed in acetone for a 10-min. period. Tested upon removal, it is found that undercured specimens have suffered a great loss in shear strength, while adequately cured specimens are little affected. All test specimens used in these tests were disks, $1\frac{1}{8}$ in. in diameter, produced under conditions as noted on the figures.

In tests upon ureas, the effect of time of cure upon shear strength is emphasized by placing test specimens in boiling water. Very large differences are observed between undercured and properly cured specimens. Similar data were obtained showing the effect of temperature and pressure.

To demonstrate the versatility of the test method, a shear strength *versus* temperature curve was run from 0 to 315 F. Tests in this instance were performed upon a general purpose phenolic molding material, produced under identical conditions of temperature and pressure during molding. The data are given for this test in Fig. 4. In conducting this test, the punch and die were maintained at exactly the same temperature as the test specimen.

In an effort to determine the effect of degree of flow upon the shear strength of molded thermosetting materials, a mold was designed, Fig. 5, to reproduce test disks after various degrees of flow. The material flows through a restricted opening, $\frac{1}{16}$ in. in diameter into a disk approximately 0.1 in. wide, and $\frac{3}{4}$ in. in diameter. This disk is connected in series through another $\frac{1}{16}$-in. diameter opening to another disk of the same proportions, and so on, until 5 or 6 disks are stacked parallel to one another. At the proper molding temperature, material was introduced and pressure applied upon the material. The time was noted for the material to stop flowing, and then 1-min. cure was allowed after that point was reached.

Results of these tests indicate that there was very little change in the shear strength of successive disks until the last one was reached. (See disks in Fig. 5.) This would indicate that, as long as full and proper flow is maintained in molding material during molding, full shear strength may be developed. However, when flow slows up and ceases, as it does in the case of the last disk reproduced, one may expect a substantial reduction in the shear strength. This method has also proved useful in comparing the flow properties of various plastics. Phenolics of good flow properties reproduced four to five disks, while ureas reproduced only one and sometimes part of the second disk.

The shear strength of various injection molding compositions was determined under varying conditions of injection pressure and temperature of plasticizing chamber. A flat portion of the piece being molded was selected for test, and all measurements made at that one location for all of the compositions molded. Good comparative results were obtained upon all of the materials. These data as determined by the punch test are shown in Table I. Tests were performed upon all samples within 1 hr. after each molding.

All of the above tests were made upon materials molded in the same mold under pressures of 16,000 psi. in the

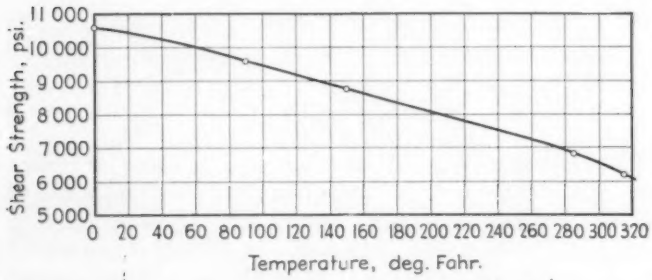


Fig. 4.—Shear Strength of Molded Phenolic as Function of Temperature of Test.

Bakelite BM 2498, 0.075-in. thickness.

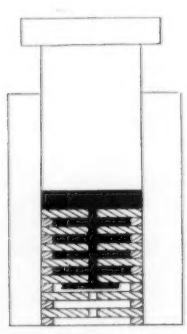


Fig. 5.

TABLE I.—SHEAR STRENGTH.

Material	Shear Strength, psi.
Polystyrene (Monsanto Chemical Co.):	
As furnished	7 200
Molded reground stock	7 000
Ethylcellulose (Dow Chemical Co.), as furnished	7 600
Cellulose acetate-butyrate (Tennessee Eastman Corp.):	
As furnished	5 300
Molded reground stock	5 000
Cellulose acetate (grade MS) (Tennessee Eastman Corp.)	7 000
Polymethyl methacrylate (Röhm & Haas Co.):	
Hard flow	10 200
Injection molding grade	9 100
Polyvinyl chloride-acetate (Carbide and Carbon Chem. Corp.):	
Low molecular weight VG-5300	10 900
Medium molecular weight VG-5800	10 000

plasticizing chamber of the injection molding machine. Injection molding temperatures for samples prepared for this test lay between 350 and 370 F., except for the polyvinyl chloride acetate which was injection molded at 300 F.

Variation of molding temperature and pressure, in particular upon polystyrene and cellulose acetate, showed negligible variation in shear strength even when molded, for example, at 5000 or 16,000 psi. in the plasticizing chamber. However, in the region of the weld marks, shear strength was usually 10 to 15 per cent lower than elsewhere in the molding.

Conclusions

For rapid, comparative tests of shear strength of plastic materials, the small punch and die method works quite effectively. Readings are usually made in less than 5 sec., and with the proper measuring apparatus will repeat with an inaccuracy not greater than 2 per cent. Shear tests designed to show the influence of molding conditions upon thermosetting materials indicate quite clearly the degree of cure of the molding material. This test is further augmented either by boiling-water immersion of ureas for 10 min., or acetone immersion of phenolics for 10 min. Differences in shear strength as function of degree of cure are more pronounced under these conditions.

Concerning the effect of flow upon the shear strength, the phenolics tested gave very little variation in any of the specimens reproduced by the specially designed flow testing mold. However, it was interesting to note that a mold of this description affords a rapid method of comparing the flow properties of various thermosetting materials. The size of the orifices and the number of disks are both variables which distinguish between the various plastics with respect to their flow. Further tests are in progress to determine the efficacy of this unit as a simple, inexpensive means of comparing flow properties.

The data reported for shear strength of injection-molding materials afford a good comparison of the outstanding grades of thermoplastic injection-molding compounds, all of which were tested in the same mold under as identical conditions as possible. Inasmuch as the plasticizing chamber of the injection-molding machine was thoroughly cleaned out between each test, there was very little opportunity for impurities to affect the flow of physical properties of the material. Fresh, unopened drums of material were used in each case.

DISCUSSION

Mr. W. N. Findley.[1]—I wish to point out one fact with which I have no doubt Mr. Delmonte is familiar but which was not mentioned in his paper. It is known, as has been demonstrated by photoelastic and analytical studies, that a load which is distributed over a small portion of the surface of a solid, produces stresses which are not uniform throughout the depth of the solid, but are highly concentrated immediately under the load and decrease rapidly with increase in distance from the surface. Hence, in punching a hole in a plate the shearing stress on the cylindrical surface of the hole which will be made in the plate is not uniformly distributed. Since the equation used by Mr. Delmonte to compute the "Shear Strength" is based upon an assumption of uniform stress distribution, the equation does not give the actual shear strength but a fictive strength similar to the "Modulus of Rupture" used in the transverse test. The results obtained by this punch test would seem to be quite useful for rapid comparative work, but it might be well to call the result by some other name than "Shear Strength."

Mr. John Delmonte.[2]—Mr. Findley is quite correct in that a large stress concentration exists at the edges of the punch and die, and I am inclined to agree with him in his comment, because we recognize that that is not a true measure of shear strength. When the punch and die used in these tests were made, we put a slight taper on the die, and provided a large clearance to punch. However, as the same punch and die were employed throughout these tests, we felt that comparative results could be obtained.

Mr. G. M. Kline.[3]—Valuable results can be obtained by using the type of flow test described by Mr. Delmonte but it seems to me there is one precaution that we should observe. It is rather distressing to find ourselves in the position of having so many different methods of determining the flow of plastics. This one has been mentioned as a possible means of evaluating the flow of plastics. There is a paper, published recently by the Bell Telephone Laboratories, giving still another method of determining the flow of plastics. And we have an A.S.T.M. tentative method for determining the flow of thermoplastics. I know of one or two other methods that have been published or are about to be published that differ from these in detail for the measure of flow of thermoplastic and thermosetting plastics. We find ourselves getting into a position of chaos in our testing procedures rather than simplifying our methods and arriving at a standard procedure for determining the test. It is a state of affairs that I think we should try to avoid as much as possible by reaching an agreement on one method for measuring a property of plastics.

[1] Instructor in Theoretical and Applied Mechanics, University of Illinois, Urbana, Ill.

[2] Technical Director, Plastics Industries Technical Institute, Los Angeles, Calif.

[3] Chief, Organic Plastics Section, National Bureau of Standards, Washington, D. C.

It is my opinion that test methods which provide alternate procedures leading to different answers are not good A.S.T.M. practice. This is no mere academic viewpoint or ideal. A.S.T.M. methods are held in high respect in engineering and scientific circles and most values reported in the literature are labeled "Determined by the A.S.T.M. Method" where these are available for the properties in question. Usually no further limitation is placed upon the value and, unless the method on the books is unequivocal as to procedure, such a label is meaningless in so far as identification of test details is concerned. The American Society for Testing Materials does not have to put its stamp of approval on every good method for determining a certain property. As I see the goal of A.S.T.M., it is to examine the various possible ways of determining a property of a class of materials and to select *the method* which appears to be the best for general testing, with respect to reproducibility, speed, and convenience. In other words, its goal is simplification by standardization on a single method, in order to avoid the confusion and lack of comparability that arises when two or more methods are used. This, of course, does not prevent the other methods from being used for research purposes or by agreement between a purchaser and seller. I would like to see all A.S.T.M. methods written in such a way as to leave no doubt as to to how a value labeled "Determined by the A.S.T.M. Method" was obtained.

MR. DELMONTE (*author's closure, by letter*).—I am heartily in accord with Mr. Kline's comments on the value of the A.S.T.M. tests and the desirability of applying them as extensively as possible. There is little doubt but that a chaotic condition would exist if everyone took liberties in designing test machines unless some standardizing influence made itself felt. However, we must not overlook the fact that in achieving universal acceptance of standard tests we must evolve methods which can be readily employed by the large majority and which would not necessarily be limited to a few who are in a position to invest in costly meshing equipment.

At the Plastics Industries Technical Institute we are equipped with standard methods and standard equipments for tests, though we also find it expedient at times to design testing procedures which might serve momentarily in lieu of a more lengthy testing procedure. It was, consequently, with this in mind that such methods as the punch test technique were developed for plastics.

Of course, in our own minds we would not personally justify any test of a special nature unless we had means and equipment for correlating results obtained thereupon with the results of the accepted standard methods.

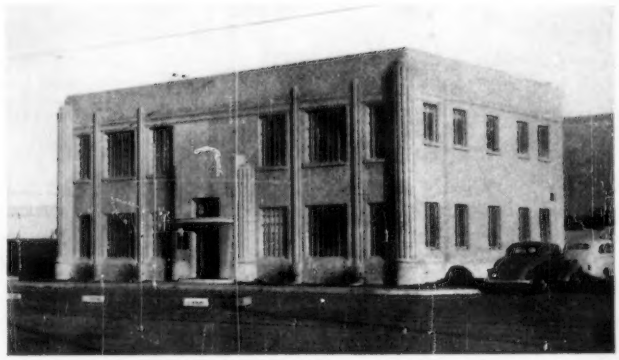
Los Angeles Harbor Department Testing Laboratory

By C. M. Wakeman[1]

EDITOR'S NOTE.—The following article, prepared at our request, describes the development of a testing laboratory and illustrates some phases of the important work undertaken. As a condensed case history it should be of interest to many testing and research engineers. The story of numerous other testing departments would bring to light many additional advantages of well organized efforts in this field.

THE MUNICIPAL harbor of Los Angeles, destined to become one of the great seaports of the world, presented serious problems to the engineers confronted with the task of building the essential facilities. Among the decisions made was that of erecting transit sheds on concrete piers, which necessitated investigations concerning the longevity of concrete in sea water. Very little was known about the subject at the time, and it was assumed that any substance that would waterproof concrete would render it completely resistant to the ravages of time, at least as long as the waterproofing medium remained effective. A small research laboratory was established by the Board of Harbor Commissioners, in 1912, for the purpose of conducting accelerated tests on the several dozen proprietary compounds then sold as ingredients to "waterproof" concrete.

It was soon discovered that research technicians were useful to the Harbor Department in other ways. There was cement to be tested, and there were gradings to be made on coarse and fine aggregates used in concrete. There was paint to be tested; and steel, sheet metal, and roofing were soon added. The Harbor Commission also learned



the advantage of checking the quality of the many other engineering materials that entered into the construction of the great harbor. Thus, another testing laboratory, born for research, was established. The narrow gap between making acceptance tests and assisting in the preparation of standards for the purchase of materials was soon bridged by the laboratory staff. In this connection, it should be mentioned that materials entirely satisfactory for other locations were frequently found to be unsuitable for use in the harbor district. Sheet metal and paint coatings illustrate the point. Galvanized iron having a zinc coating of somewhat less than $1\frac{1}{4}$ oz. per sq. ft. was used with success a few miles away from the waterfront, but experience at the latter location indicated the need of minimum coatings of $1\frac{1}{2}$ oz. or more. Likewise, a paint film that would last three to four years in the back country failed in less than eighteen months on our waterfront transit sheds. Research conducted by our laboratory has resulted in increased life of the average paint coating by 300 per cent.

[1] Testing Engineer, Los Angeles Harbor Dept., Los Angeles, Calif.

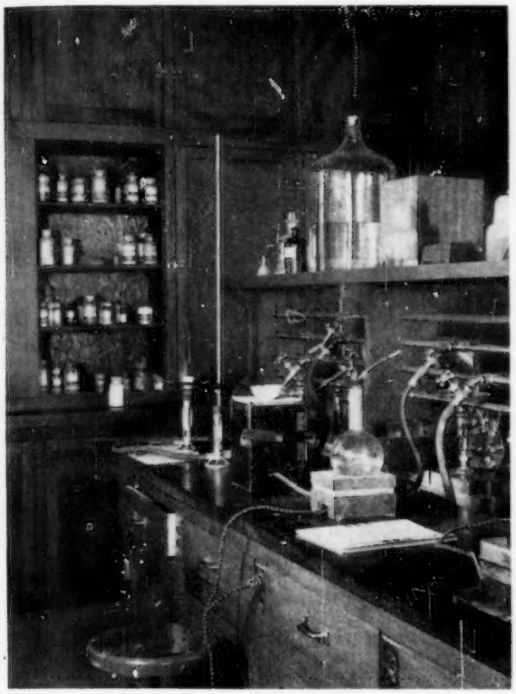


Fig. 1.—A Section of the Chemical Laboratory.

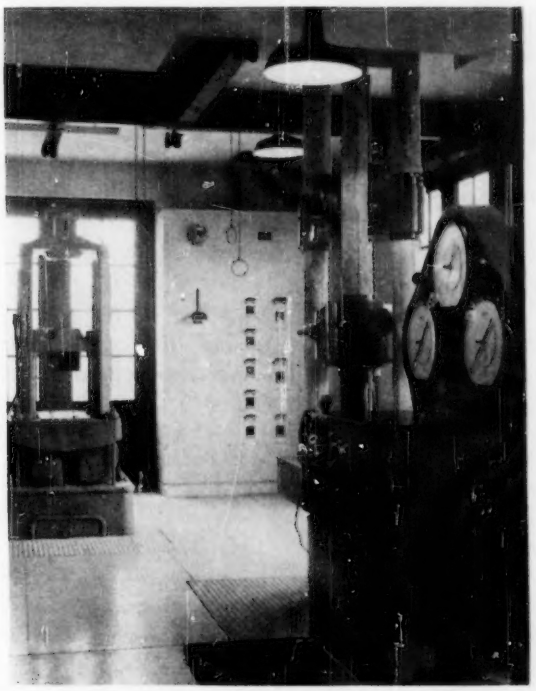


Fig. 2.—A Corner of the Physical Testing Laboratory.

Among routine materials that we now test before acceptance are the following: copper alloys for pumps and machine bearings, boats and their fittings, cement, coal for use in our blacksmith shop, concrete, concrete aggregates, creosote, petroleum products of all kinds, crude oil, natural gas, vegetable oils, paints and allied products, paving materials, Manila and wire rope, roofing paper and roofing materials, sheet metal, steel, water, and sewage; also miscellaneous items consisting of commodities such as benzene, cotton, clay, linoleum, plaster, welding rods, wood, building tile, sewer pipe, and laboratory chemicals.

With the discovery of oil on the Harbor Department's holdings in Wilmington came the necessity of checking the quantity and quality of the oil and gas produced, in order to safeguard our royalty interests. These tests were properly allocated to our testing laboratory.

The concrete, totaling annually hundreds of cubic yards, placed in harbor structures, has definite requisites for strength, porosity, etc. At the start of every job, the cement and aggregates are tested and the proportion of individual ingredients determined, so that the concrete will have an optimum cement content commensurate with requirements. This is an important point, for a considerable saving may be effected by adequate control. For example, a compressive strength of 3500 psi., involving the use of six sacks of cement per cubic yard, might be specified for a concrete wharf deck. Without means of control, the tendency is frequently to "over-cement" in order to insure the stipulated strength, thus perhaps using six and one-half, or possibly seven, sacks of cement for the same volume of concrete.

New problems are constantly arising which need the attention of the laboratory, and in most instances result in ultimate economies to the Harbor Department. The following will serve to illustrate a few of the many assignments that have been undertaken:

1. *"Waterproofing" of Concrete for Marine Use.*—If concrete were always infallible when used in marine struc-

Fig. 3.—A View of the Instrument Room.

Fig. 4.—A Corner of the Dark Room.

tures, the engineer's job would be greatly lightened. Unfortunately, it has frequently shown indications of early disintegration, due sometimes to faulty materials, frequently to inferior workmanship, and occasionally to improper usage. Development of waterproofing mediums, careful design, control, and selection of type of cement to be used constitute some of the factors that have been under investigation for many years. That considerable progress has been made can be observed by an inspection of our existing structures. That much is still to be learned is evident by perusal of modern technical literature.

2. *Paving for Transit Sheds and Wharves.*—These requirements are highly specialized, as lessees need a smooth, hard, wear-resistant surface that will not soften in summer or crack in winter, and that will survive under terrific impacts of fast, heavy-laden steel-wheel cargo carriers. Studies along these lines have progressed slowly, but we have developed marked improvements over the former wearing surfaces.

3. *Paint Studies.*—Due to the operations of the numerous oil refineries and several sewage plants in immediate proximity to Los Angeles Harbor, the atmosphere contains unusually high proportions of sulfur dioxide and hydrogen sulfide gases, in addition to the usual saline content of an ocean-front district. For many years we have conducted comprehensive field and laboratory tests in order to develop suitable formulas for the particular atmospheric conditions prevailing at this location.

4. *Wood Preservatives.*—Although the creosote impregnation of timbers has been found entirely satisfactory for inhibiting fungus growths and certain insects, it has been of questionable value where the action of marine borers is concerned. Douglas fir piling, treated with coal-tar creosote to the extent of 16 lb. of oil per cubic foot of timber, have been found to suffer attack by certain marine organisms such as limnoria within a period of six months. These animals live and propagate in wood that is so saturated with creosote as to permit its ready extraction by squeezing a fragment of the wood between the thumbnails. At the present time the laboratory is experimenting with toxic, oil-soluble additives to creosote, such as the metallic derivatives of certain organic acids. They seem to offer some promise of effectiveness.

5. *Fish Cannery Wastes.*—For a number of years it has been the practice of local fish canneries to discharge plant waste-water directly into the harbor without previously treating it. The effluent contains considerable oily matter as well as large amounts of organic solids. Preliminary studies indicate the possibility of salvaging daily 18 to 25 tons of fish scales (containing 10 per cent nitrogen and $1^1/_2$ per cent phosphorus), 22 to 40 tons of sludge cake (10 per cent nitrogen and $2^1/_2$ per cent phosphorus), and 2000 to 4000 gal. of fish oil. Research on the above project has developed several new lines of testing procedure which it is anticipated will soon be published and which may be referred to appropriate standardizing agencies for consideration. One of these, a method for the determination of sewage, sludge, and industrial wastes, proposed by Richard Pomeroy and the writer, was accepted for publication in the November 15, 1941 Analytical Edition of *Industrial and Engineering Chemistry*. This is now one of three alternate methods being considered for adoption as a standard method by a committee of the American Public Health Association.

The trend of the times seems to relate the ultimate value of all enterprises to the gold standard. An engineering laboratory, maintained for the purpose of testing the quality of materials of construction, is no exception. It is frequently regarded as a necessary liability just as the operation of a harbor is credited, or debited, according to the ratio of expenditures to income, without weighing its potential value to the community in lowering freight charges, rendering accessible potential raw materials, and aiding national defense in times of emergency.

Viewed from a monetary standpoint, our testing laboratory could hardly be set up as a revenue producer. Its latent value, however, might frequently entitle it to the credit side of the ledger. For example, during the past ten years more than 170,000 sq. ft. of galvanized iron have been rejected because of a deficiency in spelter coating. The life of the metal being in exact proportion to the quantity of zinc coating (all things being equal), it is plainly discernible that the cost of a premature replacement of defective metal might easily exceed its initial value, not to mention the inconvenience to tenants or loss of revenue during repairs.

Repetitions of the foregoing example for other commodities such as cement, paint, roofing materials, wood preservatives, lubricating oils, etc., would be equally illustrative, but for lack of space only two actual cases will be mentioned. An 18,000-lb. shipment of rope was found to have an average oil content of 4 per cent more than the specified limit. As rope is purchased by weight, the extra oil was equivalent to a deficit of 728 lb., for which the contractor allowed the Harbor Department a corresponding credit. Another case is that of a shipment of rolling door slats for a transit shed. Tests proved that the zinc coating was only 80 per cent of the amount specified. The contractor, pressed for time, asked for and received permission to maintain these doors with two coats of paint every three years for a period of nine years, as an alternative to replacement.

Routine testing has resulted in the direct rejection of an average of $5000 worth of construction materials per year. This figure does not include the many items submitted for approval prior to actual delivery on the job, and which far exceeded the above amount in value.

In addition to routine testing, our laboratory is equipped to handle the photographic needs of the Harbor Department. Each month progress pictures are taken at the various jobs, including many detail "shots" which prove so valuable when repairs are to be made at a later date. Legal photographs in connection with damage to property and with pending lawsuits are frequently made. Recently a series of photographs assisted in saving the Harbor Department a considerable sum in a dispute.

The inspection of structures for dry rot and termites, and of substructures for marine borers has been assigned to the testing laboratory. With approximately 42,000 linear feet of wharves, frequent inspections are necessary to avoid excessive maintenance and to show incipient conditions which might be dangerous if not corrected.

Thus laboratory work has come to include testing of a wide variety of materials used by the Harbor Department and inspections of structures in which materials are used.

Engineering Defense Training Course in A.S.T.M. Testing Methods Given at Illinois Institute of Technology

EDITOR'S NOTE.—If any evidence were needed to indicate the great importance of materials inspection and testing in the present emergency, one has but to examine the roster of engineering defense courses which have been under way for the past two years in leading American colleges and universities. In practically every school where series of courses have been given, there have been one or more devoted specifically to materials testing and inspection or both. One immediate result of heavy enrollment in these courses was complete exhaustion of the edition of the A.S.T.M. publication "Selected A.S.T.M. Standards for Students in Engineering," issued in March; another of 6000 copies was published in October of this past year. Recently there came to our attention a most interesting course at the Armour College of Engineering and at our request those in charge of the course have supplied information which is incorporated in the accompanying article. Undoubtedly, there are many very interesting aspects of courses in materials in other leading schools. In at least one university the only courses listed are materials inspection and testing with three of these scheduled.

THE NATIONAL Defense Training Program has thrown the spotlight of attention upon one of the essential elements in the procurement of materials, namely, specifications describing the desired quality, properties, and performance characteristics which can be subsequently measured with definite tests.

Our nation, intent upon being far better prepared industrially than ever before, delegated the U. S. Office of Education to institute a mammoth Engineering Defense Training Program. This took form in the selection of leading engineering colleges throughout the country to carry out the training of personnel to handle efficiently all lines of engineering defense work.

Armour College of Engineering, of Illinois Institute of Technology, through its president, H. T. Heald, was one of the first institutions to pledge cooperation with the Government in this program. Mr. J. I. Yellott, who had recently been induced to leave an extremely successful consulting practice to become Head of the Department of Mechanical Engineering at the Institute, was appointed Chairman of the Engineering Defense Training Committee by President Heald. Professor Yellott's knowledge of industrial problems enabled him to advise the establishment of courses of training that would be the most beneficial to the Government and private industry, not only in our present emergency but for our future industrial development. Consequently, with the problem of procurement attaining a greater magnitude than ever before, and demanding greater assurance of receiving materials of desired quality, it was felt that courses covering this field would be most beneficial. Professor Yellott, therefore set up a course "A.S.T.M. Testing Methods" in the first Engineering Defense Training program in January, 1941. He secured J. Earl Harrington, who possessed wide experience in the coordination of procurement procedures, inspection and testing of materials, to conduct the course.

The object of the course is that of training men for positions of supervision in the procurement field and particularly with respect to the testing and inspection of materials and equipment. The title of the course, A.S.T.M. Testing Methods, is significant in that one of its main purposes is to acquaint the student with the scope of the A.S.T.M. It was felt that no other standardization body, save perhaps the Federal Government itself, could provide as broad a foundation for study as could the A.S.T.M.

A brief outline of the subject matter covered by the course is given below:

1. Government and Private Purchasing
2. Principles of Purchasing by Specification
3. Function of Inspection and Testing
4. Research Related to Purchasing
5. Engineering Specifications
   - Requisites of good specifications
   - Interpretation of specifications
   - Advantages and disadvantages of specifications
6. Testing and Inspection Organization
   - The engineer of tests
   - The chief inspector
   - The staff—laboratory, field, and office
7. Strength of Materials
8. Testing Machines
9. Physical Tests
10. Chemical Laboratory Equipment
11. Methods of Analysis
12. A.S.T.M.
    - History, purpose, scope
13. A.S.T.M. Standards and Tests
    - Ferrous metals
    - Non-ferrous metals
    - Nonmetallic constructional materials
    - Fuels
    - Petroleum products
    - Electrical materials
    - Plastics
    - Paints
    - Rubber products
    - Textiles
    - Naval stores
    - Leather
    - Other miscellaneous materials
14. Inspection of Materials
    - Consideration of above from inspection viewpoint
15. Inspection and Testing of Equipment
    - Structures
    - Machinery
    - All types of equipment, mechanical, electrical, etc.

The entrance requirements for the course were rigid. Applicants were required to have been graduated from an engineering college or to possess extensive industrial experience in lieu of the educational requirements. With the students possessing a fundamental knowledge, it was possible to direct their thinking along executive lines so as to provide a supply of trained specialists in this field.

The first class of 35 students was organized in January, 1941, and scheduled to meet two evenings each week for 20 weeks. The course proved so popular that it was necessary to organize another class in less than a month. In March, 1941, therefore, the second class was formed. Its enrollment of 75 comprised practically the entire Navy inspection staff in the Chicago district, in addition to men from private industry. Toward the end of the 20-week course of the first class, the students petitioned the Institute to organize an advanced class. Their request was granted, and in the latter part of April 1941, the Ad-

vanced Section was formed, continuing throughout the summer.

The Engineering Science and Management Defense Training Program instituted in the fall of 1941 found the demand for the A.S.T.M. course as great as ever and consequently two sections were formed and are now in progress. Present indications are that there will be a demand for the continuation of the course in the next Engineering Defense Training Program.

The remarkable success of the A.S.T.M. course is borne out by the fact that approximately 90 per cent of the students received promotions as a result of having completed the course. In both the Government service and private industry several students were jumped two or three levels to new executive positions.

It is encouraging to know of the wide-spread interest in A.S.T.M. standards and tests. This interest should accrue to the benefit of the Society for years to come. Uppermost in our minds, however, at this time is our country's emergency.

The existing crisis demands the cooperation of all men and all organizations. It also demands that a reserve of technical experts be provided to man the stations in our vast procurement system; a reserve of men with fundamentally sound training coupled with an executive viewpoint that will promote the most efficient cooperation of Government and industry; men whose scientific training is general enough to be practical, and flexible enough to meet the emergencies and readjustments when they occur.

Philadelphia Student Night Features Program on Aviation Materials

ANOTHER IN THE series of successful meetings sponsored by the A.S.T.M. Philadelphia District Committee featured a student night, at The Franklin Institute, Friday, December 5. Engineering students of many schools in the district were present at the meeting on the invitation of the District Committee. The technical session covered aviation materials with four very pertinent talks by leaders in the specific fields. The program was as follows:

Aircraft Engines—R. R. Moore, Metallurgist, Naval Aircraft Factory, Philadelphia, Pa.

Aircraft Structures—G. G. Cudhea, Chief Production Engineer, Fleetwings, Inc., Bristol, Pa.

Aviation Fuels—David Shepherd, Standard Oil Co. of New Jersey, New York, N. Y.

Emergency Specifications—C. L. Warwick, Secretary-Treasurer, A.S.T.M.

Preceding the first speaker, L. E. Ekholm, Vice-Chairman, who presided with J. W. Harsch, Chairman of the Program Committee, in the absence of F. G. Tatnall, District Chairman, described briefly the setup of the Society and outlined phases of its work pointing to important fields of activity and citing the growing significance of the field of materials engineering stressing particularly testing and research. He pointed to the large number of student members in A.S.T.M. and the fact that there were represented in the membership members of the faculty of over 100 leading educational institutions.

Mr. Moore presented a most excellent discussion of some of the metallurgical problems involved in the production of aircraft engines, brought about in part by tremendously increased power. He covered some of the materials most widely used including aluminum alloys and the alloy steels, explaining why they were best suited for the parts. It was pointed out that while all of the metallurgical problems were not yet completely solved, work was continuing constantly so that the needs of the engine designer could be met.

Mr. Cudhea's interesting paper was featured by a humorous quotation on the use of plastics in aircraft structures; he outlined to those present some of the difficulties involved in the present program and evaluated various materials used for structural parts, tieing these in carefully with the general type of aircraft produced. Tests which have been under way for some time seem to offer promise for certain nonmetallic products to help speed production.

Mr. Shepherd handled his subject, one in which a less able speaker might well have lost his audience, in a way that any individual with reasonable technical training could easily understand. He, of course, concentrated on the problems incident to the production of so-called 100 octane aviation fuel basing his discussion on a clear definition of just what the octane rating meant. He referred to tremendous demands on the part of the Government Services for this type of fuel and compared the quality of the fuel we can produce from our resources with the type used by the Germans. While it is reassuring to know of the superior quality of our material, Mr. Shepherd expressed reasonable doubt as to any scarcity developing in fuels as such as far as German needs were concerned.

The discussion of emergency specifications was largely confined to a review of the work of the Federal Specifications Executive Committee in issuing Federal Emergency Alternate Specifications; a brief description of the procedure by which A.S T.M. can promptly turn out Emergency Alternate Provisions; and the drawing of a clear picture of the work of the OPM Bureau of Conservation. Reference was made to the one important phase of this work, namely, the development of National Emergency Steel Specifications.

Invitations were extended by the District Committee to members of the faculty and students in engineering schools or colleges with engineering departments located in the Philadelphia area. Despite adverse weather conditions and certain conflicting meetings, there were upward of 100 students present.

Following the technical session, refreshments were served to the students, members, and guests. Including students, a total of about 160 were present.

The following members of the Philadelphia District Committee were active in arranging the meeting: E. J. Albert, L. E. Ekholm, H. M. Hancock, J. W. Harsch, S. J. Leonard, G. H. Mains, A. O. Schaefer, and J. F. Vogdes, Jr. It is believed this was the first instance of a District Committee featuring a student night. The success of the venture may pave the way for this as an annual feature.

Important Specifications, Emergency Alternate Provisions, Proposed at Steel Committee Meeting

THE TWO-DAY SERIES of meetings of Committee A-1 on Steel held on January 12 and 13 at The Hotel Warwick, Philadelphia, were featured, in addition to the heaviest attendance of any of these meetings, by definite action on several emergency alternate provisions to be set up immediately, decisions to undertake at once important new specification work, and many constructive recommendations from the subcommittees to get the various standards and tentative standards in final shape for the 1942 Book of Standards. Another matter on which there was intensive discussion, notably in the A-1 Advisory Committee meeting, concerned the manganese situation. Many of the matters covered must be confirmed by letter ballot action.

Acting on various requests it had received to initiate specifications work covering materials for use at subatmospheric temperatures, the Advisory Committee of A-1 gave jurisdiction in this field to Subcommittee XXII, the title of which is to be "Valves, Fittings, Piping and Flanges for High Temperature and Subatmospheric Temperature Service." While some additional personnel may be added to this group, headed by Dr. A. E. White, the membership already includes many technologists qualified to deal with the development of specification requirements, including several men who are active in the work of the Joint Research Committee on the Effect of Temperature on the Properties of Metals. It is anticipated that a new section of the subcommittee will be assigned this specification work.

EMERGENCY ALTERNATE PROVISIONS

The emergency alternate provisions, which it is expected will be issued after approval by letter ballot and by the chairman of Committee A-1, affect several of the casting specifications and the specification for nuts (A 194). Subcommittees VIII on Steel Castings and XXII on Materials for High-Temperature Service approved numerous changes suggested in the interest of expediting production. Complete details will be published in either the March or May ASTM BULLETIN, depending on when action can be obtained.

Emergency provisions are to be set up in the following specifications:

Carbon-Steel Castings for Miscellaneous Industrial Uses (A 27 – 39)
Carbon-Steel and Alloy-Steel Castings for Railroads (A 87 – 36)
Alloy-Steel Castings for Structural Purposes (A 148 – 36)
Carbon-Steel Castings Suitable for Fusion Welding for Miscellaneous Industrial Uses (A 215 – 41)
Carbon-Steel Castings Suitable for Fusion Welding for Service at Temperatures up to 850 F. (A 216 – 41 T)

In A 27 and A 87 it is proposed to raise the temperature of the furnace charge at which a casting can be removed from the furnace from the present 500 to 750 F. Since foundry heat treatment facilities are taxed beyond capacity it is hoped this practice will be widely employed. In A 27 the manganese maximum of one per cent is to be deleted which should make it possible in some cases to furnish steel from a low-alloy heat rather than to make a special higher carbon steel. An important emergency provision in Grade B-2 will lower the tensile strength value from 70,000 to 65,000 psi. with all other tensile values remaining the same. This should enable some foundries to produce this grade from the same heat as castings made to certain other specifications.

In the railroad castings (A 87) raising the weight of a casting at which a separate test coupon must be cast from 150 to 500 lb. is in the interest of increased production. In the alloy specifications (A 148) a new grade is to be provided with a tensile strength of 105,000 psi., 85,000 psi. yield point, 18 per cent elongation, and 45 per cent reduction of area and in specifications A 215 emergency alternate changes in certain heat treatment requirements are being set up. The temperature for removal from the furnace is to be raised and modifications made in some grades, affecting chemistries and physical properties.

Since requirements in the two specifications covering carbon and alloy welding castings for valves, flanges, and related material for use at elevated temperatures (A 216 and A 217) are apparently used to a considerable extent to cover turbine and related castings, emergency alternate provisions are being set up to cover these uses. Rather than change existing grades new modified requirements will be provided, in this way avoiding any confusion or conflict with the use of existing grades for piping materials.

MANGANESE

A number of the emergency provisions to be established for castings should result in conservation of manganese. This subject has been the basis of a valuable report prepared by a special committee of the American Iron and Steel Institute under the direction of Dr. C. H. Herty, Metallurgist, Bethlehem Steel Co. The A-1 Advisory Committee discussed this matter at some length after hearing firsthand details from Dr. Herty, who had been invited to attend the meeting, with the resulting action that the chairman of each of the A-1 specification-writing groups will be asked immediately to undertake studies or to develop a report indicating what may be done in the respective fields either in the interest of short-time or long-time conservation of this very important element. Although there is no great immediate urgency with respect to available manganese, there was unanimous consensus that the Steel Committee would be prudent in studying promptly the specifications in its charge. Dr. Herty cited cases where with reduced manganese, resulting in a very considerable annual saving, absolutely no production kinks had arisen nor inferior quality had resulted. The necessity of considering consumer specifications was emphasized since consumption of manganese is about evenly divided between so-called consumer and producer specifications.

(*Continued on page 47*)

JANUARY 1942

ASTM Bulletin

NO. 114

TWO-SIXTY
SOUTH BROAD ST.
PHILADELPHIA, PENNA.

A.S.T.M. and the Victory Program

IT IS STILL TOO early to make any very definite appraisal of the effect of the War Effort on A.S.T.M. activities. That there will be need for all our technical knowledge, we know, and many A.S.T.M. members will be serving in key positions. Also there will be imperative need for standard specifications in the procurement of materials in order to conserve materials and production capacity, so that some of our committees may be called upon to take prompt action to meet the emergency. How the Society can best contribute to the War Effort and how it can best function under the present conditions is, even as we write, receiving the very careful consideration of the Executive Committee.

This being a war of materials and production, materials engineers will play a most important part. It is but natural to expect that with the extreme demands being placed upon our members, some of our committee work, of a currently less urgent nature, may need to be held in abeyance. Also, some short cuts may be necessary in our standardization procedure. Fortunately, much of the spade work for the 1942 Book of Standards is already completed. In addition to the backlog of standards already available, requiring no further revision, a good deal of the committee work on new and revised standards had already been accomplished, or at least much of the preliminary work completed, prior to the Declaration of War. Upon approval at the next annual meeting or by action of Committee E-10 on Standards before then, these new and revised standards will go directly into the 1942 Book.

Accordingly, we look forward to the appearance of a monumental publication that should represent one of the greatest contributions to the War Effort. It will make available to industry over 1000 standards (well over half of them purchase specifications). Many now enter into countless Government contracts and subcontracts for war materials and attendant structures. They are available and are utilized by industry in general, whether for domestic production or in the shipments abroad.

As Americans we want to eliminate all possible confusions. We must utilize *all* our people, *all* our productive capacity, *all* our MATERIALS in top efficiency. In days like these, there is little or no excuse for the specification of nonstandard materials. We must concentrate on standard materials through the use of standard specifications.

March 21, 1902

ON THIS DAY SEVEN men, by name Henry Marion Howe, Charles Benjamin Dudley, Edgar Marburg, Robert W. Lesley, Mansfield Merriman, Albert Ladd Colby, and William R. Webster, petitioned the Judges of the Court of Common Pleas No. 2 in Philadelphia that they be incorporated as the "American Society for Testing Materials" and stated that "the corporation is formed for the Promotion of Knowledge of the Materials of Engineering, and the Standardization of Specifications and the Methods of Testing" and further indicated that "the said corporation is to exist perpetually."

Later, on June 4, 1902, Saml. W. Pennypacker, President Judge, after stating that the same appeared lawful and not injurious to the community "did order and direct that the said charter be and is approved."

And so the A.S.T.M. officially got under way as a separate American entity after existing for some four years as an American Committee of the old International Association. Lukewarm interest abroad in specifications, and the desirability of intensive work in this field in the United States, primarily dictated an American organization.

The progress made, the illustrious members who have worked and gone, the meetings held, the friendships started and cemented with the years, the disappointments of a few—and many other points—during these four decades, would make many interesting stories.

But we are content to let this bare reminder of the almost forty years of A.S.T.M. stand—simplicity frequently may be the best emphasis.

There has been a great deal of life in the Society thus far, and whether Walter Pitkin with his "Life Begins at Forty" is right or wrong, there's a great deal of life left in the old "gal" yet.

What About Manganese?

THOSE ATTENDING the recent Advisory Committee session of Committee A-1 on Steel heard an earnest statement by Dr. C. H. Herty on the "manganese situation," a reasoned outline of how much of this essential steelmaking element we have, what our production and imports now are and what they may be, and an analysis of why it seems unquestionably prudent to take immediate steps to conserve this material.

At present estimated rates of use without curtailment we have enough to last for a reasonable period. *If* the bottoms are available to bring in ore, the period will be extended.

Also, *if* the supply of other alloying elements proves to be adequate, manganese will not need to be substituted for them.

We have seen limits reached in other fields—aluminum, nickel, chromium—what next?

There are many remedial measures that can be taken, provided they are taken promptly.

The consumer and the producer must share responsibility to this end. The producer may be able to cut down manganese to a considerable extent, and still meet the necessary physical requirements.

Some producers can conserve more than others—not all results will necessarily check as well as the two structural

mills which independently, but under control of one neutral metallurgist, cut manganese five points (0.05 per cent) and then another 0.05; each to run into trouble quickly at the lower figure—but to experience no trouble whatsoever at the first cut. With steel tonnages at these mills in the millions, considerable manganese will be saved.

We understand some companies at considerable expense have installed equipment to better the already good record of reducing manganese losses in the open hearth.

Consumers can frequently afford to relax requirements on manganese—perhaps at the expense of a slightly lower factor of safety. But if we lose the war—due to insufficient production—safety factors will mean little to us.

In the steel castings field, for example, many users could undoubtedly accept emergency provisions, reducing the tensile strength values (see page 33 of this BULLETIN). Usually a lower physical value permits manganese reduction.

It is improbable that any over-all recommendations can be made, but there are many fields where some measures can be taken. Undoubtedly the Steel Committee's studies will clarify the situation as it affects the A.S.T.M. specifications, and studies by other bodies which have sponsored steel standards might result in corresponding changes.

A leading editor has said that this war will probably be won by something new and that it probably will be something new in the management of materials that will enable us to bring to bear more effectively in production the overwhelming superiority that we possess in natural resources. Since we do not have an overabundance of manganese, we *must* manage it efficiently.

New Non-Ferrous Metal Specifications

NEW TENTATIVE Specifications for Aluminum Bronze Sheet and Strip (B 169 – 41 T) were issued on November 28, 1941, by action of Committee E-10 on Standards. These specifications, prepared by Committee B-5 on Copper and Copper Alloys at the request of the Federal Specifications Executive Committee will serve as a guide in the revision of the Federal Specification for Aluminum Bronze Bars, Plates, Rods, Shapes, Sheet, and Strip (QQ-B-666).

The new specifications cover commercial aluminum bronze sheet and strip commonly used for drawing, forming, stripping, and bending. Two compositions are covered, designated alloys A and C, having tensile strength ranges of 45,000 to 50,000 psi. in the soft temper and 55,000 to 60,000 psi. in the hard temper for alloy A; and 50,000 to 55,000 psi. in the soft temper and 60,000 to 65,000 psi. in the hard temper for alloy C. Since aluminum bronze is used for many purposes where the special requirements cannot be adequately covered by any of the ordinary physical tests, the specifications recommend that samples or drawings be submitted to the manufacturer in order to secure an adjustment in temper to suit the service conditions.

These specifications represent an important addition to the group of specifications for copper alloys prepared by Committee B-5 that are of interest in the National Defense Program.

By similar action of Committee E-10 new Tentative Specifications for Oxygen-Free Electrolytic Copper Wire Bars, Billets, and Cakes (B 170 – 42 T) have been accepted. These specifications were prepared by Committee B-2 on Non-Ferrous Metals and Alloys and cover a type of copper suitable for electrical purposes. The material is produced without the use of residual metallic or metalloidal deoxidizers and must have a purity of 99.92 per cent and a conductivity of 100 per cent. To determine that the material is free from cuprous oxide the specifications require a microscopic examination at 75 diameters. Test specimens are required to stand a minimum of four bends of 90 deg. each without fracture in the embrittlement test.

These new tentative specifications have been published in pamphlet form and a copy may be obtained by members of the Society without charge. Extra copies are available at 25 cents each.

Tentative revisions in the Standard Specifications for Lake Copper Wire Bars, Cakes, Slabs, Billets, Ingots, and Ingot Bars (B 4 – 27),[1] and for Electrolytic Copper Wire Bars, Cakes, Slabs, Billets, Ingots, and Ingot Bars (B 5 – 27)[1] have also been accepted for publication on the recommendation of Committee B-2. The revisions provide for a change in the resistivity requirements for electrolytic copper wire bars in Section 3 of Specifications B 5 and the resistivity requirements for low-resistance lake copper wire bars in Section 4 of Specifications B 4 from the present maximum of 0.15436 ohm (meter, gram) to the new value of 0.15328 ohm (meter, gram) at 20 C. (annealed). This reduction in resistivity requirements raises the conductivity from 99.3 per cent to an equivalent of 100 per cent. These revisions were prepared at the request of Committee B-1 on Copper and Copper-Alloy Wire for Electrical Conductors.

[1] 1939 Book of A.S.T.M. Standards, Part I, pp. 536, 541.

Typographical Errors in Current Specifications

ATTENTION IS directed to important typographical omissions in two specifications covering the following:

Concrete Aggregates (C 33 – 40). 1940 Supplement, Part II, page 84; also "A.S.T.M. Standards on Mineral Aggregates," page 1.

Electrolytic Cathode Copper (B 115 – 41 T). 1941 Supplement, Part I, page 367.

In the specifications for aggregates, Table I gives permissible limits for deleterious substances. In the second column (maximum permissible limits, per cent by weight) two values are missing. The limits of 3 per cent and 5 per cent should be inserted to cover material finer than No. 200 sieve used, respectively, in concrete subject to abrasion, and for all other classes. These figures correspond to 2 and 3 per cent as shown in the first column of the table.

In the tentative specifications for electrolytic cathode copper, Section 2, paragraph *b* specifies that the copper shall have a resistivity "not to exceed 0.15428 international ohms per metergram." The correct value of the resistivity should be "0.15328."

Several New Sustaining Members

Effective as of January 1, 1942, six company members of the Society have authorized a transfer to sustaining membership and one company has taken a new membership of this class. These organizations have been affiliated with the Society for many years and the actions are in part a recognition by them of the important work being carried on under A.S.T.M. auspices in the field of standardization and research. Also each case represents further cooperative effort on their part to forward A.S.T.M. work, technical men affiliated with these companies having participated for years in important technical projects.

With these new memberships the number of sustaining members is now 146.

The receipt of a copy of every publication issued by the Society which includes quite a number ordinarily furnished only on purchase, a complete set of the Book of Standards and an extra set furnished on request, and extra copies of the ASTM Bulletin are some of the more tangible assets of this sustaining membership class. There is no change in the committee setup, sustaining members having the same rights and privileges as exercised by a so-called company membership.

Sustaining members contribute $100 dues yearly while other corporate or company members pay $30. Individual membership, which also applies to Government departments, universities, libraries, and the like, is $15.

New Sustaining Members

The Autocar Co., W. J. Diederichs, Metallurgist, Ardmore, Pa.

While this membership represents the first tie-in with the Society as a company member, B. B. Bachman, Vice-President in Charge of Engineering, has been a personal member of the Society for over 20 years, his membership dating from 1919. For many years he has been concerned with the work of Committee D-2 on Petroleum Products, serving as a member of Technical Committee A on Gasoline. This organization is a very large user of many materials which have been covered in A.S.T.M. committee work, particularly in the field of metals. Mr. Bachman is retaining his personal membership in the A.S.T.M. and has designated W. J. Diederichs to represent the company. The latter has been very active in association work; he is a Past-Chairman of the Philadelphia Section of the American Society for Metals and is at present one of its directors.

Lukens Steel Co., L. P. McAllister, Metallurgical Engineer, Coatesville, Pa.

Continuously since 1902 this company has been affiliated with A.S.T.M. This year it will join the select group of forty-year members. From 1902 to 1926 its membership in the Society was represented by C. L. Huston, Vice-President. In 1926 Stewart Huston, Plant Metallurgist, became the company's representative and in 1934 he became a personal member of the Society. For the past several years Mr. McAllister who has been very active in A.S.T.M. matters, particularly those involving Committee A-1 on Steel, has represented the company's membership. Stewart Huston, now secretary of the company, serves on Committee A-5 on Corrosion of Iron and Steel. W. G. Humpton, Metallurgical Sales Engineer, represents the company on Committees A-1 on Steel and A-2 on Wrought Iron and Dr. W. G. Theisinger, Welding Engineer, serves on Committee E-7 on Radiographic Testing.

Worth Steel Co., R. W. Lilley, Engineer of Tests, Claymont, Del.

The membership held by this organization dates from 1919. For several years Mr. Lilley has represented the company, succeeding R. H. Jeffers. Mr. Lilley for a number of years has been an active member of Committee A-1 on Steel, serving on three of its subcommittees dealing with structural steel for bridges, buildings, and rolling stock, ship steel, and boiler steel.

Medusa Portland Cement Co., H. Vanderwerp, Vice-President In Charge of Operations, Cleveland, Ohio

The membership of this company dates from the affiliation of the Sandusky Cement Co. in 1923, the Medusa Portland Cement Co. having absorbed this company in 1929. In addition to a company membership, Harry L. Vanderwerp, Research Engineer, at the Wampum, Pa., office is a personal member. The company has been interested in different phases of A.S.T.M. work, in particular the activities of Committee C-1 on Cement. Mr. H. Vanderwerp represents his company on this committee and serves on its subcommittees concerned with masonry cement and sulfate resistance.

Crucible Steel Co. of America, C. T. Edgerton, Manager, Bureau of Statistics, New York, N. Y.

While affiliation with the Society as a company member dates from 1928, Mr. Edgerton having served as the representative since that time, C. Morris Johnson, Chief Chemist, Park Works, at Pittsburgh has been a personal member since 1918. The representatives of the company are active in many A.S.T.M. technical committees. Mr. Edgerton serves as chairman of Subcommittee IV on Spring Steel and Steel Springs of A-1 and is a member of the Research Committee on Fatigue of Metals. Mr. L. S. Bergen, Associate Director, Metallurgy and Research, also serves on Committee A-1 and is a member of its subgroup on materials for high temperature service. He represents his company on Committee A-10 on Iron-Chromium, Iron-Chromium-Nickel, and Related Alloys, serving on several subcommittees. J. P. Larkin, Manager, Alnico Magnet Division, Atha Works, Harrison, N. J., is a member of Committee A-6 on Magnetic Properties, while C. M. Johnson, formerly active in Committee A-1 before its Subcommittee XII on Chemical Analysis was merged into Committee E-3 on Chemical Analysis of Metals, is a member of the latter group serving on several of its subgroups.

In addition to his service on A.S.T.M. Committees, Mr. Edgerton is a representative of the Society on the A.S.M.E. Research Committee on Metal Springs.

The Bonney-Floyd Co., Edward W. Campion, President, Columbus, Ohio.

This company has been represented in the Society membership as a corporate member for 17 years. Mr. Campion has been the company representative in the Society for several years, previous to which he was a personal member. He has been very active in the work of Committee A-1 on Steel, serving on Subcommittee VIII on Steel Castings in which industry his company is one of the leaders and he has taken a leading part in efforts to bring the Government, A.S.T.M., and related specifications more nearly in line. He also serves as a member of Subcommittee XIII on Methods of Physical Tests and in addition to representing his company he also represents the American Foundrymen's Assn. on the Steel Committee. R. H. Frank serves as a representative of the company on Committee E-7 on Radiographic Testing.

Walworth Co., Inc., F. H. Morehead, Vice-President, New York, N. Y.

The affiliation of this company with A.S.T.M. dates from 1923. Mr. Morehead, who has been very active in A.S.T.M. work, has represented the membership for a number of years. In addition to membership on the Steel Committee's subgroups on pipe and tubing and on materials for high-temperature service on which he has served for upward of 15 years,

he is also active in the work of Committees A-3 on Cast Iron and A-7 on Malleable-Iron Castings. He represents the Manufacturers Standardization Society of the Valve & Fittings Industry on two A.S.A. Sectional Committees of which the A.S.T.M. is sponsor or joint sponsor, namely, B 36 on Standardization of Dimensions and Materials of Wrought-Iron and Wrought-Steel Pipe and Tubing and G 8 on Zinc Coating of Iron and Steel. Two other technical men in the company hold personal memberships: J. J. Curran, Research Metallurgist, at the Greensburg, Pa., office is active in the work of Committees B-5 on Copper and Copper Alloys, Cast and Wrought, and E-7 on Radiographic Testing; and Harry McCarthy, Assistant Chief Engineer at the Kewanee branch who has been a member since 1928.

Emergency Alternate Federal Specifications

CONTINUING THE policy of announcing the latest emergency alternate Federal specifications, there are listed below those emergency alternate Federal specifications received since the December issue of the BULLETIN, the specification numbers with a brief description being given.

Under the plan being followed the Federal specification itself is not changed, but where the emergency alternate requirements may be considered suitable alternates for the materials covered by the Federal specifications, they can become effective. Their issuance is primarily in the interest of conserving certain strategic materials.

A.S.T.M. Headquarters is prepared to distribute a limited number of the emergency alternate Federal specifications on request. Advantage has been taken of this offer by several members to obtain copies of those items which concern them especially.

Specification Number	Description
E-AA-D-191	Desks; Steel
E-DDD-R-271	Ribbons: Computing and Recording-Machine
E-H-B-531	Brushes; Scrubbing, Deck
E-OO-L-131b	Laundry Appliances (supersedes E-OO-L-131b dated August 27, 1941)
E-OO-M-81	Machines; Slicing, Meat
E-QQ-A-327	Aluminum-Alloy (AL-61), (Aluminum-Magnesium-Silicon); Plates, Sheets, and Strips
E-QQ-A-331a	Aluminum-Alloy (AL-53) (Aluminum-Magnesium-Silicon-Chromium); Bars, Rods, Shapes, and Wire
E-QQ-A-351a	Aluminum-Alloy (Aluminum-Copper-Magnesium-Manganese); Bars, Rods, Shapes, and Wire
E-QQ-C-591a	Copper-Silicon-Alloy; Bars, Plates, Rods, Shapes, Sheets, and Strips
E-QQ-C-593	Copper-Silicon-Alloy; Castings
E-QQ-I-666	Iron, Malleable; Castings
E-QQ-W-321	Wire; Brass
E-QQ-W-432	Wire, Steel; Market
E-QQ-W-461	Wire, Steel (Carbon); Bare and Zinc-Coated
E-RR-B-771a	Buckets; Metal, Galvanized
E-RR-F-221	Fencing; Wire (Barbed, Netting, and Woven), Black, and Galvanized
E-RR-R-191	Receptacles; Waste-Paper, Metal, Office, and Lobby
E-SS-P-166	Pencils; Lead
E-UU-T-81b	Tags; Shipping and Stock (supersedes E-UU-T-81b, dated August 13, 1941)
E-W-P-131a	Panelboards; Equipped with Automatic Circuit-Breakers (supersedes E-W-P-131, dated May 23, 1941)
E-WW-C-566	Conduit; Steel, Flexible
E-WW-C-621a	Couplings; Hose, Cotton (Rubber-Lined) and Linen (Unlined)
E-WW-C-646	Couplings; Hose, Water-Suction
E-WW-P-448a	Pipe-Fittings; Brass or Bronze (Threaded or Brazed), 125-lb.
E-WW-P-461	Pipe-Fittings; Bronze (Threaded), 250-lb.
E-WW-P-491	Pipe-Fittings; Cast-Iron, Drainage
E-WW-P-501a	Pipe-Fittings; Cast-Iron (Threaded)
E-WW-P-521a	Pipe-Fittings; Malleable-Iron (Threaded), 150-lb.
E-WW-T-787	Tubing, Aluminum-Alloy (AL-52), (Aluminum-Magnesium-Chromium); Round, Seamless
E-WW-T-790	Tubing, Aluminum-Alloy (AL-53), (Aluminum-Magnesium-Silicon-Chromium); Round, Seamless
E-WW-U-516	Unions; Brass or Bronze; 250-lb.
E-WW-U-531	Unions; Malleable-Iron or Steel, 250-lb.
E-WW-U-536	Unions; Malleable-Iron or Steel, 300-lb.
E-ZZ-H-451a	Hose, Fire; Cotton, Rubber-Lined

Membership Picture

THE CLOSE-OF-THE-YEAR statistics on membership indicate that the trend in 1941 was encouraging. Although the total number of new members, 370, was eight less than for 1940, the net gain for the year, due to fewer resignations and delinquents, was 156 compared with 125 for the previous year. This brings the membership as of December 31, 1941, to 4492, highest in A.S.T.M. history and comparing with the previous peak in 1930 of 4417. Adding to this total the number of student members, 572, there are over 5000 people affiliated with A.S.T.M. Of the regular membership, 84 are juniors, about 3200, individuals; 1040 are so-called company or corporate members; and 139, sustaining members. These figures apply as of the close of the year and are changed materially by the large number of new members whose election in January is announced in another portion of this BULLETIN, including seven new sustaining members, bringing the number in this class to 146.

Of the new members, 248 were individuals, libraries, and related institutions; 36 were juniors; and 86 were company or corporate members.

A report on the number of people actively concerned with A.S.T.M. work should include an additional 1100 engineers, and materials men who serve on Society and affiliated committees as additional representatives of their companies or institutions, but who are not personally affiliated with the Society.

Last Call for Meeting Papers

DETAILED CONSIDERATION will be given to the program for the 1942 Annual Meeting to be held in Atlantic City, June 22–26, by Committee E-6 on Papers and Publications at its meeting about the middle of February. At this time offers of papers for presentation at the annual meeting will be studied from the standpoint of importance, nature of the particular problem involved, and also its relation to other topics on the program.

While a number of offers have already been received, there are undoubtedly still a number of individuals who may have papers in course of development, or under consideration, and who may wish to transmit offers. These should be received at A.S.T.M. Headquarters not later than February 16; blanks to be used in transmitting the information can be obtained on request.

1941 An Outstanding Year for A.S.T.M.

Standardization, Research, Membership, Finances—Reach All-Time High

From the condensed information and statistics recorded below it will be seen that 1941 was indeed an outstanding year for A.S.T.M. and that the number of new standards published, the membership, and annual receipts were at all-time highs. Several very important research projects were consummated and notable progress recorded in others.

Many of the A.S.T.M. activities were motivated by the National Emergency. This not only affected very definitely many specification activities, but it also had a very decided influence on the industrial activities of Society members, a number of whom are now serving in responsible OPM or other Government capacities.

General

It is difficult to evaluate completely the impact of the National Defense, now the "Victory" program, on A.S.T.M. work because of the multiplicity of effects. Numerous committee activities were definitely accelerated to provide needed standards and data, particularly in the field of metals including steel, copper and copper alloys and die castings, electrical heating and resistance alloys, but this was also true in numerous nonmetals fields—petroleum products and lubricants, rubber products, and others. Committees covering these materials have cooperated in a number of emergency matters with various Government branches, or have developed essential information. At the same time representatives of Army, Navy, and other departments have been particularly active in committee work.

The Society has been aiding directly through the loan to OPM of the Secretary-Treasurer C. L. Warwick, who helped in organizing Government conservation and related specifications activities. He is now devoting a considerable portion of his time as Chief of the Specifications Branch, Bureau of Industrial Conservation, the important work of which group was described in the December Bulletin. A number of very active A.S.T.M. members including two of the Society officers, Vice-President Dean Harvey, and Arthur W. Carpenter, member of the Executive Committee, each of whom is on loan from his company, are members of the staff of OPM.

One important project justifies special mention, namely, the development of Emergency Steel Specifications, under OPM auspices, sponsored jointly by A.S.T.M., Society of Automotive Engineers, and the American Iron and Steel Institute, with Mr. Warwick as administrator (the personnel of certain technical advisory committees is listed in this Bulletin). A large number of Society members, particularly those concerned with the work of Committee A-1 on Steel, are leaders in this important work aimed to assist in increased production of steel by concentration on a limited number of compositions, sizes, and shapes.

Of like significance is the intensive work of Committee B-5 on Copper and Copper Alloys, Cast and Wrought, because of the importance of the various materials covered in its work in the Victory Program.

Standardization Developments

The accompanying curve showing the number of standards and tentative standards is significant not because it records an increase, but because of the rate of increase. It is but natural that the total number of A.S.T.M. specifications and tests should increase each year. But more proposed standards termed "tentative specifications and tests" were issued in 1941 than in any other year. Seventy-five new standards were approved for publication at the annual meeting and subsequently Committee E-10 on Standards approved 30 additional new specifications and tests. These items were listed in the August, October, and December Bulletins.

Of the 1043 standard and tentative specifications and tests now issued, 650 are formal standards and 393 are proposed specifications and tests termed "tentative" in A.S.T.M. parlance. These combined figures show that during 1941 the total increase was 91. This figure, not notable as a numeric fact, nevertheless in terms of A.S.T.M. standards represents a great many meetings, long hours of discussion, voluminous correspondence, detailed editorial study, etc.

Significant Committee Specification Work

The intensive standardization activities of the standing technical committees were particularly notable, including Committees B-5 on Copper and Copper Alloys, with 15 new standards; D-1 on Paint, Varnish, Lacquer, and Related Products, 12 new standards; and the following committees which had from three to ten new specifications and tests: A-1 on Steel; B-2 on Non-Ferrous Metals and Alloys; C-16 on Thermal Insulating Materials; D-2 on Petroleum Products and Lubricants; D-6 on Paper and Paper Products; D-9 on Electrical Insulating Materials; D-11 on Rubber Products; D-13 on Textile Materials; and D-20 on Plastics.

Six of the copper alloy specifications cover materials for sand castings, some of these being important consolidations of other specifications, and two were tests, one for expansion of copper and copper-alloy tubing (pin test) (B 153), and the mercurous nitrate test (B 154). Of the D-1 specifications, five cover important pigments and two of the remainder were significant tests—method for preparation of steel panels for exposure tests of enamels (D 609), and an important new method for evaluating degree of resistance to rusting on painted iron and steel surfaces (D 610).

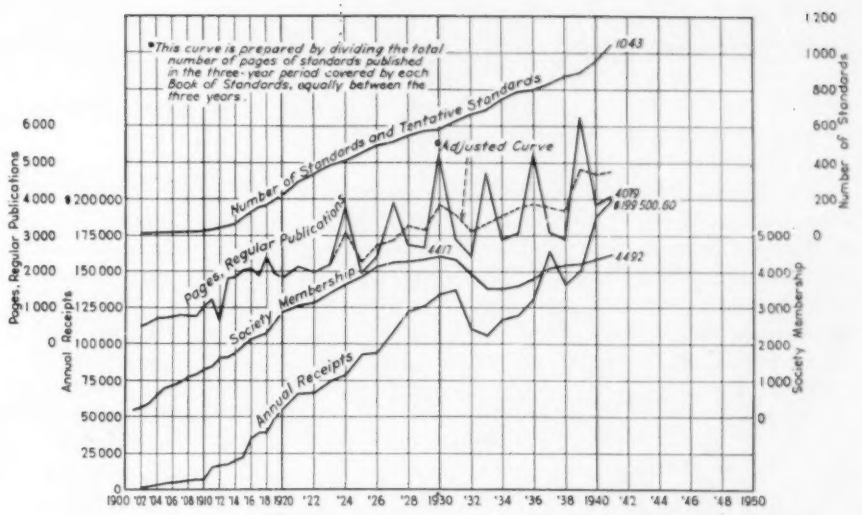
Among the materials covered by the nine important new specifications completed by Committee A-1 were low-alloy structural steel (high yield) (A 242); carbon and alloy forging blooms and billets (A 248); heat-treated wheels (A 244); hot-worked tie plates (A 241); structural steel sheets (A 245 and A 246); ring and disk forgings (A 243); and types of boiler and superheater tubes.

The nine specifications promulgated by Committee B-2 cover refined nickel and high-nickel alloys in the form of tubing, rods and bars, and sheet and strip, many of the

products being used in pressure vessels, naval equipment, and related categories (B 160 through B 168).

Committee C-16 submitted the first of a series of new standard test procedures, covering bulk density (C 164); capacity and volume change (C 166); thickness and density (C 167); compressive and flexural strength of block type thermal insulating materials (C 165); sampling and preparation of specimens for testing of thermal insulating cements (C 163).

Several of the new and revised standards approved on the recommendation of Committee D-2 were of especial significance, one providing specification requirements for aviation gasolines (D 615); a test for knock characteristics of aviation fuels (D 614); somewhat revised requirements for knock characteristics of motor fuels (D 357); and a test for ignition quality of Diesel fuels (D 613).



Among the tests covered in the new standards in the field of paper and paper products are folding endurance (D 643); quantitative determination of moisture (D 644); thickness (D 645); basis weight (D 646); conditioning paperboard and fiber boxes for testing (D 641); and compression tests on corrugated and solid fiber boxes (D 642).

Committee D-20 on Plastics has been cognizant of the important nature of its work and no other Society group is more intent in pushing forward important standards and research matters (see research article in this issue for additional notes). Urgently needed new standards completed by the committee in this field cover flammability (D 635); surface irregularities (D 637); diffusion of light (D 636); and with Committee D-9, a revised test for impact resistance (D 256).

Other very significant new specifications and tests would include those covering electrodeposited coatings of nickel and chromium on steel, copper and zinc (A 166, B 141, and B 142).

New methods of chemical analysis of soda-lime glass (C 169), new and revised tests for electrical insulating materials; distortion under heat (D 648); compressive, flexural, and tensile strength (D 649, D 650, and D 651); and punching quality of laminated sheets (D 617) are other important accomplishments of standards work during the year.

In the field of rubber products, five important new items were completed—testing of automotive air brake and vacuum brake hose (D 622); compression fatigue of vulcanized rubber (D 623); tear resistance (D 624); rubber latex (D 640); and battery containers (D 639).

Of the numerous standardization accomplishments of the textile committee certain were particularly significant, including new specifications for corduroy fabrics (D 625); treated fabrics (D 626); also test for evaluating compounds to protect fabrics against insects (D 582); testing asbestos tubular sleeving (D 628); and quantitative analysis of textiles (D 629).

Mention might be made of the new test for determining fire-retardant properties of wood (C 160); specifications for reinforced brick masonry (C 161); several new specifications and tests for soaps; and standardized requirements for slow-setting emulsified asphalts (D 631) and for sodium chloride (D 632).

Important Data from Research Programs

Since this Bulletin contains a survey of new research activities undertaken during the year or of existing programs in which very significant progress was made, little space can be justified here in reviewing specific fields, yet because a few of the year's research developments were of great importance, they should be mentioned. For example, the Report of the Joint Research Committee on Effect of Temperature on the Properties of Metals covering "Impact Resistance and Tensile Properties of Metals at Subatmospheric Temperatures" was a monumental one, culminating many month's work on the part of the numerous authorities, and which was made possible only by the very close cooperation of leading American companies and metallurgists who submitted available data. Not only is it the most important thing of its kind in this field for over a decade, but it came at a time when not only industry, but various Government branches could make pertinent use of the data.

The very valuable data resulting from atmospheric exposures of wire and wire fencing were given in the report of Committee A-5 on Corrosion of Iron and Steel. Since the material has been on exposure for only four years, the committee drew only tentative conclusions.

The detailed report on investigations to select a suitable test for fire-retardant properties of wood is of outstanding interest particularly since it falls in a field where there are relatively few specifications and tests. As submitted by Committee C-5 it constitutes one of the most extensive research reports of the year.

Membership and Finance

While membership and financial matters normally do not fit into a discussion of accomplishments, in an over-all picture of A.S.T.M. during 1941, it should be noted that the number of members—company, individual, sustaining, junior, student combined—reached an all-time high—4492—compared with the previous high in 1930 of 4417. There is further discussion of membership statistics in an-

other part of the BULLETIN, also an extensive list of the new members who have become affiliated with the Society as of January, 1942. The number of sustaining members as this BULLETIN goes to press is 146; corporate members exceed 1040 in number; and there are more than 3340 individual members.

The March BULLETIN will contain an analysis of the finances, including a graphic visualization of the income dollar and how it was used. It will be seen from the accompanying chart that of the former there were some $199,500 and of this amount approximately $175,500 were used. The favorable balance of about $24,000 includes $6000 earmarked for the 1942 Book of Standards. Sales of publications and income from membership were at an all-time high.

OUTSTANDING MEETINGS

Society meetings are significant from many angles. The annual meeting is essential in consummating work on standards and in affording a technical forum for the presentation of technical papers and reports. A.S.T.M. committee reports, of course, must be approved at this meeting. The annual Committee Week held in the spring affords an opportunity for many of the Society's committees to meet in a concentrated period. Adding to the spring and annual meetings those held by district committees in various industrial centers, all constitute an important means of promoting the activities of the Society and to the individual they afford an opportunity to meet his associates in A.S.T.M. and make important contacts.

Annual Meeting and Exhibit:

There were more members, more committee members, and more visitors registered at the Forty-fourth Annual Meeting held in Chicago than in any other time, a total registration of 1553 being a new high. This figure does not include ladies, nor does it include representatives of exhibitors and several thousand people who attended the Sixth Exhibit of Testing Apparatus and Related Equipment in progress throughout the week. This Exhibit, together with the Fourth Photographic Exhibition and Competition was one of the best yet held and brought forth many compliments from members, visitors, and exhibitors alike.

The Chicago Committee on Arrangements sponsored a new event—a cocktail reception combined with a reception to the officers of the Society past and present, and a very interesting Golf Tournament was planned by the local group. The technical program was a strong one—well diversified—as a glance at the current *Proceedings* now going in the mails will indicate.

Spring Meeting and Committee Week:

Held in Washington the Spring Meeting was notable for two technical symposiums: one on Color—Its Specification and Use in Evaluating the Appearance of Materials; and another on New Methods for Particle Size Determinations in the Subsieve Range. The numerous technical papers in these two symposiums have been issued as special publications.

The registration of members and committee members during Committee Week established another record, with about 1025 listed, which figure does not include members of certain other committees meeting at the same time but not at the headquarters' hotel. There were more than 200 committee meetings in Washington throughout the week.

District Meetings:

Several interesting local meetings sponsored by the Society's district committees were held, the annual spring one in Detroit featured by four addresses by outstanding authorities on the general subject "Changes in Materials Due to Defense Requirements." There were over 350 present at the technical session.

Particular activity in this respect was noted in the Philadelphia District where three meetings were held, two in the spring covering replacement materials, and the recent December meeting described in this BULLETIN, featuring student night. At each of these meetings leading materials engineers covered topics of significance to the A.S.T.M. members. The Southern California District group, centered in Los Angeles, also held two very significant meetings during the year, one on February 20, at which a lecture was presented on "Materials Testing Problems Arising from the Advance in Aircraft Performance," and another on October 28—an Open Forum on "Specifications, Their Importance in the Present Emergency" at which leading authorities in various materials fields comprised a panel which introduced, developed, and guided discussion of the subjects.

The Cleveland Committee also held an outstanding meeting with well-known technologists active in A.S.T.M. work discussing specifications in the present emergency. There were about 300 present at this meeting.

EXTENSIVE PUBLICATIONS

A direct reflection of an active year are publications, for to be usable, the specifications and research data must be available in published form and be widely disseminated. Consequently, the 1941 Supplements to the Book of A.S.T.M. Standards were voluminous, the three parts aggregating some 1700 pages. The Index to Standards published in December, 1941, which among other functions serves as a combined Index to the Supplements as well as the Standards publications aggregate over 196 pages with an edition of 17,000 copies.

It will be noted from the accompanying diagram that the number of pages in regular publications total 4079. This figure is reached by adding the pages in the *Proceedings*, Index, Spring Meeting symposiums and pages of technical articles in the ASTM BULLETIN, plus the 1941 Supplements.

The six issues of the 1941 BULLETINS were bigger than ever with text pages totaling 327 of which 174 are technical papers or reports. A list of important special publications issued during the year would include the compilation of Standards for Students in Engineering (9000 copies printed), the report of the Joint Research Committee covering "Properties of Metals at Subatmospheric Temperatures," and the "X-ray Diffraction Data for Chemical Analysis," a set of over 4000 cards giving data on the interplanar spacings corresponding to the three most intense lines of the X-ray diffraction patterns for over 1300 substances.

Investigation of Quick Methods for Determining Sodium Oxide and Potassium Oxide in Portland Cement

By W. C. Hanna,[1] L. N. Bryant,[2] and T. A. Hicks[3]

EDITOR'S NOTE.—The complete report as presented at the meeting of A.S.T.M. Committee C-1 on Cement, October 21, 1941, gives the results detailed in two extensive tables. Those interested in studying the details of the report should communicate with W. C. Hanna, chairman of the Working Committee.

THE RESULTS OF the eighth investigation sponsored by the Working Committee on Methods of Chemical Analysis, of Committee C-1 on Cement, on a study of quick methods for determining sodium oxide and potassium oxide in portland cement, are presented in a concise form as Table I in this paper. The methods tried and the samples used are briefly described as follows:

METHOD I: *A.S.T.M. Standard Method, C 114 – 40, Sections 20 and 21.*—Known as method II in the fourth investigation (cooperative investigation of methods for determining sodium oxide and potassium oxide in portland cement in 1936). The results with sample AJ (same as sample K in the fourth investigation) were obtained in 1936 except those of laboratories Nos. 2 and 3 which were obtained in 1941. The means and probable errors for ten laboratories in 1936 were 0.48±0.025 per cent Na_2O, and 0.25±0.008 per cent K_2O for sample AJ (K) by the standard method. Sample AK is a mixture of equal parts of Cement Reference Laboratory comparative test samples Nos. 3, 4, and 5. The results for sample AK are calculated from the results obtained with the separate C.R.L. samples by the standard method in 1939 and 1940, except those of laboratories Nos. 2 and 3 which were obtained with the composite sample in 1941.

METHOD II: *Glaze's Method with Modifications.*—Cement is treated with nitric acid, perchloric acid, and hydrofluoric acid. Sodium is precipitated as sodium zinc uranyl acetate. The precipitate is allowed to stand 2 hr. and, after filtering, is washed with the precipitating reagent, ethanol, and ether. Potassium is precipitated as potassium chloroplatinate. The precipitate is dissolved in water and the platinum is reduced to the metallic state. Na_2O and K_2O are calculated from $NaZn(UO_2)_3(CH_3CO_2)_9 \cdot 6H_2O$ and Pt, respectively.

METHOD III: *Glaze's Method as Modified by Diener and Others.*—Similar to method II, but the precipitate of sodium zinc uranyl acetate is allowed to stand 30 min. instead of 2 hr. and the precipitating reagent is not used in the washing. The precipitate of potassium chloroplatinate is washed with Gladding wash and its weight is used directly for the calculation of K_2O.

METHOD IV: *Berk and Roller's Method as Modified by Ford and Others.*—Similar to the method used by Portland Cement Association. Cement is treated with hydrochloric acid and acetic acid. Na_2O and K_2O are determined as in method II.

METHOD V: *Berk and Roller's Method with Modifications.*—Similar to method IV. Cement is treated with acids as in method IV but Na_2O and K_2O are determined as in method III.

Since results by A.S.T.M. standard methods are used as standards for judging other methods, data previously obtained with the standard method for sodium oxide and potassium oxide[4] are included in the table. It was considered unnecessary to ask the laboratories again to make determinations by the A.S.T.M. standard method. However, two of them, not knowing the identity of the samples, volunteered to make such determinations. Their comparison with previous results is as follows:

Laboratory	Date	Sample AJ		Sample AK	
		Na_2O, per cent	K_2O, per cent	Na_2O, per cent	K_2O, per cent
2	Early[a]	0.48	0.23	0.15[b]	0.50[b]
	1941	0.51	0.26	0.17	0.55
3	Early[a]	0.47	0.24	0.15[b]	0.55[b]
	1941	0.48	0.25	0.15	0.55
Mean values from Table I		0.49	0.26	0.16	0.53

[a] 1936 for sample AJ, 1939 and 1940 for sample AK.
[b] Calculated from the separate analysis of three different samples. (See the description of method I.)

The results check with the means within experimental error and the largest deviation is no more than 0.03 per cent.

The analysts were requested to estimate the elapsed time (not including time for letting the work stand overnight unattended) required for a single sample and the maximum number of samples possible to be analyzed in one week. The averages of their estimates are as follows:

Method	Approximate Time Required for a Single Sample, hr.	Approximate Possible Number of Samples Analyzed in 5 days of 8 hr. Each
I	26.0	11.9
II	20.0	18.2
III	19.1	18.2
IV	16.4	23.2
V	16.2	22.6

Variation in their estimates was expected for the following reasons:

1. Most analysts had other duties and could not devote themselves to the determination of alkalies over a long period of time,
2. Few analysts were thoroughly familiar with all the methods and therefore could overcome difficulties only after considerable experience,
3. Different analysts have different opinions as to how fast an analysis can be hurried along with safety,
4. Some work faster than others, and
5. A few may tend to overestimate while a few others may tend to underestimate.

However, it can be seen that all the quick methods are considerably more rapid than the standard method and are more suitable for the "mass production" of results.

The preferences of the laboratories for the quick methods as an A.S.T.M. alternate method are as follows:

Method	Number of Laboratories For Na_2O	For K_2O
II	3	2
III	2	3
IV	3	5
V	3	1

[1] Chief Chemist and Chemical Engineer, California Portland Cement Co., Colton, Calif.
[2] Superintendent, Cement Division, Pittsburgh Coke and Iron Co., Neville Island, Pa.
[3] General Chemist, Universal Atlas Cement Co., New York, N. Y.
[4] See Standard Methods of Chemical Analysis of Portland Cement (C 114 – 40), Sections 20 and 21, 1940 Supplement to Book of A.S.T.M. Standards, Part II, p. 16.

The analysts, not knowing the identity of the samples and not being asked to use the standard method on them, naturally base their preference of method as an alternate method on convenience, speed, and availability of equipment to a large extent and on precision to some extent in some cases. Accuracy is a factor which must be taken into consideration by the Working Committee in making its recommendation and by Committee C-1 in making its decision.

The choice appears to lie between method IIIa (Glaze's method as modified by Diener) and method IVa (Berk and Roller's method as modified by Ford). The purification of residue by washing the crucible with hot water after weighing the crucible and residue was found to be necessary only in the case of potassium oxide in method V. The most significant data covering these methods and method I (the standard method) are given in boldface type in Table I and are averaged as follows:

	Method I	Method IIIa	Method IVa
Average range for all	0.08	0.06	0.09
Average mean for all	0.48	0.47	0.51
Average deviation[a]	...	0.015	0.030
Average probable error for all	0.018	0.013	0.021

[a] Calculated from the deviations of all means from the means of method I.

The difference in procedure between methods II and III or between methods IV and V is so small that we may assume that those who prefer method II most of all would prefer method IIIa to method IVa, and that those who prefer method V most of all would prefer method IVa to method IIIa. On this basis we find that five laboratories prefer method IIIa and six of them prefer method IVa. One laboratory made no choice because it had trouble with all the methods and did not have the time for a thorough study. No method was found to be free of trouble by all laboratories but it is believed that with experience any one of these quick methods can be made to work. The chief difficulty in method IIIa seems to be the tendency of the acid solution of cement to spatter and "bump" during a hurried evaporation while the chief trouble with method IVa appears to be incomplete elimination of silicon dioxide and ferric oxide which cause filtration and washing to be slow. With proper equipment and organization of work one will not find it difficult to handle the evaporation of the acid solution of cement in method IIIa. Many analysts have used method IVa without contending with slow filtration and washing.

The advantages of method IVa over method IIIa are greater speed and lower cost in equipment. On the other hand the summary of data given above demonstrates the superiority of method IIIa in precision and accuracy. Range and probable error are measures of precision while mean and average deviation are measures of accuracy. It may be a matter of opinion as to how large a deviation may be and yet be considered as being within experimental error, but most of us will probably consider the deviation of method IVa from the standard method (method I) in the case of sample AJ to be excessive.

It is reasonable to ask what assurance there is that the results of method I approach the truth more closely than those of the other methods. There is no absolute proof on this point and there is no sample of portland cement with analysis certified by the National Bureau of Standards. In the absence of such proof and sample, method I is accepted as the standard for comparison from logical considerations. It is essentially the J. Lawrence Smith method which has been used all over the world for a long time. The ideal condition for accuracy is the removal of impurities before the recovery of the desired component. Method I meets this condition more nearly than do the quick methods. In the standard method the large amount of calcium is removed before potassium is separated from sodium. It is true that an error in the determination of potassium oxide causes one in that of sodium oxide, but it does not cause an appreciable error in the sum of the oxides unless the original error is large. In the quick methods sodium and potassium are precipitated in the presence of large quantities of impurities. The precipitates may or may not be in their theoretical forms and the impurities may or may not be completely removed in the following process of filtering and washing. Strontium and phosphate ion, if present, cause high results.[5] The accuracy of such methods cannot be assumed without comparison with a method which is considered to be more reliable.

From these considerations the Working Committee believes that method IIIa (Glaze's method as modified by Diener) is suitable, and is more suitable than the others, as

[5] H. H. Barber and I. M. Kolthoff, "A Specific Reagent for the Rapid Gravimetric Determination of Sodium," *Journal*, Am. Chemical Soc., Vol. 50, p. 1630 (1928).

TABLE I.—ANALYTICAL RESU

Method[a]	Sodium Oxide, Na_2O									Potassium Oxide, K_2O							Total	
	I	II		III		IV		V		I	II	III		IV	V		I	II
		a	b	a	b	a	b	a	b			a	b		a	b		a
Minimum	**0.43**	0.46	0.46	**0.42**	0.46	**0.51**	0.46	0.49	0.49	**0.24**	0.23	**0.24**	0.24	**0.23**	0.30	0.23	**0.73**	0.66
Maximum	**0.52**	0.54	0.53	**0.51**	0.51	**0.59**	0.58	0.55	0.55	**0.30**	0.30	**0.28**	0.30	**0.34**	0.50	0.33	**0.78**	0.82
Mean	**0.49**	0.50	0.50	**0.48**	0.49	**0.54**	0.53	0.53	0.52	**0.26**	0.27	**0.26**	0.26	**0.28**	0.38	0.29	**0.75**	0.74
Probable Error,[d] plus or minus	**0.023**	0.017	0.016	**0.020**	0.011	**0.017**	0.032	0.013	0.013	**0.014**	0.015	**0.009**	0.012	**0.024**	0.049	0.026	**0.016**	0.031
Minimum	**0.14**	0.10	0.10	**0.11**	0.09	**0.13**	0.12	0.11	0.11	**0.47**	0.49	**0.52**	0.52	**0.52**	0.56	0.54	**0.63**	0.65
Maximum	**0.17**	0.18	0.18	**0.15**	0.15	**0.20**	0.20	0.17	0.17	**0.59**	0.63	**0.58**	0.59	**0.62**	0.67	0.65	**0.76**	0.71
Mean	**0.16**	0.14	0.14	**0.13**	0.12	**0.16**	0.16	0.14	0.14	**0.53**	0.57	**0.55**	0.55	**0.57**	0.62	0.58	**0.70**	0.69
Probable Error,[d] plus or minus	**0.007**	0.019	0.017	**0.008**	0.012	**0.014**	0.014	0.013	0.014	**0.028**	0.026	**0.012**	0.013	**0.025**	0.029	0.023	**0.029**	0.016

[a] In the various methods, procedure "a" is based on the difference between the original weight of the crucible and the weight of the crucible and precipitate; proce "b" is based on the difference between the weight of the crucible and precipitate and the weight of the crucible (with water-insoluble impurities, if any) after washing hot water.

[b] Total alkali equivalent to $Na_2O + 0.807\ K_2O$. All alkali is assumed to be Na_2O. In method I the weight of Na_2SO_4 and K_2SO_4 is multiplied by 0.4364×2 factor 0.4364 being the ratio of Na_2O to Na_2SO_4. In other methods where Na_2O and K_2O are determined separately, the factor 0.807 is used as indicated. It is the of K_2SO_4 to K_2O multiplied by 0.4364. This method of calculation is used as a specification by California Division of Highways.

an A.S.T.M. alternate method for determining sodium oxide and potassium oxide in portland cement. It has been recommended to Committee C-1 for adoption as a tentative alternate method. The proposed method appears in an Appendix to this paper.

It is to be noted that Table I carries, in addition to separate values for Na_2O and K_2O, values for $Na_2O + K_2O$ given in three common ways of reporting.

Cooperating Laboratories.—The names of the cooperating laboratories are given below:

California Division of Highways: T. E. Stanton, Materials and Research Engineer; G. H. P. Lichthardt, Senior Chemical Testing Engineer.
California Portland Cement Co.: O. D. Guire, Jr., Analyst.
Michigan Alkali Co.: J. P. Buckmann.
Monolith Portland Cement Co.: O. C. Hart, Chief Chemist; A. L. Hansen; George M. Brown.
National Bureau of Standards, Clay and Silicate Products Division: P. H. Bates, Chief; J. J. Tregoning, Assistant Chemist.
Portland Cement Association: H. F. Gonnerman, Manager of Laboratory; C. L. Ford, Associate Chemist.
Riverside Cement Co.: Herbert Woods, Chief Chemist; John Sauer.
Superior Portland Cement, Inc. (Washington): A. W. Hooton, Chief Chemist.
Tennessee Valley Authority: P. J. Freeman, Principal Materials Engineer; C. D. Susano.
U. S. Bureau of Reclamation: R. F. Blanks, Senior Engineer.
Universal Atlas Cement Co.: T. A. Hicks, General Chemist; L. G. Sprague, Chief Chemist; F. P. Diener.
Western Precipitation Corp.: Evald Anderson (deceased, July 19, 1941); Leo W. Briggs; R. J. Nestell, Analyst.

NOTE.—The list of laboratories does not correspond to the tabulation of results.

The Working Committee and Committee C-1 are deeply indebted to these laboratories. The work was a great task and their assistance is appreciated particularly at this time when increased production keeps their personnels busy and some laboratory supplies are difficult to obtain. The quick methods in their principal features are not recent inventions but they required experimentation before they, in modified forms, could be used satisfactorily. F. W. Glaze of the National Bureau of Standards and C. L. Ford of Portland Cement Association are to be congratulated for their part in the development of these methods. F. P. Diener of Universal Atlas Cement Co. did a great deal of experimental work in the preliminary stage of the investigation and suggested several worth-while changes in the methods.

SPECTROGRAPHIC DETERMINATIONS OF SODIUM OXIDE AND POTASSIUM OXIDE

Hercules Powder Co., through W. W. DeLaney, and Michigan Alkali Co., through J. P. Buckmann, have made some spectrographic determinations of sodium oxide and potassium oxide for the Working Committee. Their results compared with those by the A.S.T.M. standard method, are as follows:

Laboratory	Sample AJ		Sample AK		C.R.L. No. 4[a]		C.R.L. No. 5[a]	
	Na_2O, per cent	K_2O, per cent	Na_2O, per cent	K_2O, per cent	Na_2O, per cent	K_2O, per cent	Na_2O, per cent	K_2O, per cent
13[b]	A	0.10	B	0.18	D	0.63	C	0.13
14	0.18	0.15	0.13	0.19	...	...	...	...
Method I[c]	0.49	0.26	0.16	0.53	0.06	1.06	0.08	0.30

[a] Cement Reference Laboratory comparative test sample.
[b] Laboratory No. 13 was not able to make quantitative determinations of Na_2O but designated the qualitative concentrations by letters which were A for highest to D for lowest.
[c] The results by method I for samples AJ and AK are the means given in Table I.

The results reported by the Cement Reference Laboratory for their comparative test samples Nos. 4 and 5 are an interesting illustration of the fact that when a group of analysts make comparative tests and a large part of them get poor results, the most probable values cannot be arrived at by the impartial application of mathematics.

	C.R.L. No. 4[b]		C.R.L. No. 5[b]	
	Na_2O, per cent	K_2O, per cent	Na_2O, per cent	K_2O, per cent
Mean for group No. 1	0.19	0.79	0.14	0.29
Probable error for group No. 1	0.137	0.23	0.094	0.103
Mean[a] for group No. 1	0.14	0.79	0.10	0.27
Probable error[a] for group No. 1	0.080	0.23	0.036	0.066
Mean for group No. 2	0.08	1.06	0.08	0.30
Probable error for group No. 2	0.036	0.14	0.011	0.017
Mean[a] for group No. 2	0.06	1.06	0.08	0.30
Probable error[a] for group No. 2	0.016	0.14	0.011	0.017

[a] Chauvenet's criterion applied.
[b] Cement Reference Laboratory comparative test sample.

Group No. 1 is the group of 102 laboratories which made the determinations as requested by the Cement Reference Laboratory and by the specified method. Group

PRESSED AS PERCENTAGES.

all, $Na_2O + K_2O$						Total Alkali Equivalent to $Na_2O + 0.807\ K_2O$[b]										Total Alkali Equivalent to $Na_2O + 0.658\ K_2O$[c]									
III		IV		V		I	II		III		IV		V			I	II		III		IV		V		
a	b	a	b	a	b		a	b	a	b	a	b	a	b			a	b	a	b	a	b	a	b	
0.70	0.77	0.77	0.83	0.77		0.67	0.61	0.61	0.65	0.64	0.72	0.72	0.77	0.67		0.63	0.56	0.56	0.60	0.60	0.68	0.68	0.73	0.69	
0.80	0.84	0.84	1.00	0.86		0.73	0.77	0.76	0.75	0.74	0.79	0.79	0.94	0.80		0.69	0.72	0.71	0.71	0.70	0.75	0.78	0.87	0.75	
0.75	0.81	0.81	0.88	0.81		0.70	0.69	0.69	0.69	0.69	0.75	0.75	0.83	0.76		0.66	0.65	0.65	0.65	0.65	0.71	0.72	0.77	0.72	
0.020	0.017	0.017	0.045	0.020		0.021	0.031	0.030	0.021	0.020	0.017	0.016	0.041	0.016		0.017	0.031	0.031	0.022	0.020	0.016	0.020	0.035	0.013	
0.65	0.65	0.64	0.67	0.65		0.54	0.55	0.55	0.55	0.54	0.57	0.57	0.56	0.55		0.56	0.47	0.47	0.47	0.46	0.45	0.49	0.48	0.47	
0.76	0.79	0.78	0.95	0.77		0.65	0.60	0.60	0.61	0.65	0.67	0.66	0.79	0.64		0.46	0.52	0.52	0.52	0.53	0.58	0.57	0.67	0.55	
0.69	0.71	0.71	0.78	0.71		0.60	0.58	0.58	0.58	0.58	0.61	0.61	0.67	0.61		0.51	0.49	0.50	0.49	0.49	0.52	0.53	0.57	0.52	
0.024	0.027	0.026	0.061	0.029		0.024	0.011	0.012	0.013	0.023	0.024	0.018	0.045	0.024		0.022	0.010	0.011	0.011	0.014	0.023	0.016	0.036	0.021	

[b] Total alkali equivalent to $Na_2O + 0.658K_2O$. Na_2O and K_2O in equivalent amounts are assumed to have an equal effect on concrete. K_2O is converted in terms of Na_2O, the factor 0.658 being the ratio of the molecular weight of Na_2O to that of K_2O. This method of calculation is used as a specification by the U. S. Bureau of Reclamation.
[c] The probable error of a single observation. P. E. = $\pm 0.674\sqrt{\Sigma d^2 \div (n-1)}$; where Σd^2 is the sum of the squares of the deviations and n is the number of observations.

No. 2 represents 8 of those 102 laboratories which cooperated with the Working Committee in the investigation of quick methods for determining sodium oxide and potassium oxide in portland cement. The numbers of values rejected by Chauvenet's criterion are 26 in group No. 1 and 1 in group No. 2. The criterion involves no personal opinion as to a standard of accuracy and its factor for rejection is based on the deviations of the individual results and the number of results themselves. Probable error does not tell how close the mean is to the accurate value. It merely indicates the degree of precision in the results. A high probable error means low precision which may be attributed to the method or the workers or both. It is clear that the quality of workers is an important factor in any study of methods. The laboratories in group No. 2 are among the best in the country and most of their erratic results may be attributed to lack of familiarity with new and difficult methods. Their means for C.R.L. samples are considered to be correct and therefore are used in judging the spectrographic results.

Another laboratory, which agreed to make spectrographic tests on samples AJ and AK, has not been able to find time to do so. However, their work with other samples did not give satisfactory results. The spectrographic results which have been reported thus far do not encourage much hope that spectrographic determination of sodium oxide and potassium oxide can become practical in the cement industry in the near future. However, there are two other laboratories which agreed to make such tests but have not reported them. Until their progress is known it is not possible to say what the next step in this study will be.

Definitions

There seems to have been some confusion as to what terms should be used in discussing the compounds of sodium and potassium. The Working Committee on Methods of Chemical Analysis was asked to look into this matter and make some suggestions.

It is the practice of the Working Committee to use scientific names rather than common names when possible or practical. Scientific names have definite meanings while common ones often do not and may lead to misunderstanding. We prefer "sodium oxide" to "soda" and "potassium oxide" to "potassa" or "potash." "Sodium oxide" means just the oxide while "soda" may mean the oxide, hydroxide, carbonate, or bicarbonate of sodium. If it is desired to use common names, one can say "soda and potassa" but it is not good usage to say "soda and potash." Both "soda" and "potassa" have a Latin origin while "potash" has a Dutch derivation.

"Alkali" is a common name which has no single scientific equivalent. It has two plural forms, "alkalies" and "alkalis." As far as we can find, both plural forms are proper though pronounced in different ways. "Alkalies" is used in A.S.T.M. publications and seems to be the form preferred by most writers and we recommend its use. In a narrow sense "alkali" means the alkaline compounds of the alkali metals only but in its widest sense other alkaline compounds, such as calcium oxide, magnesium oxide, and alkaloids, are included. When cement chemists and concrete technologists talk about alkalies in cement, they have in mind all the compounds of sodium and potassium though some of them, such as sodium sulfate, are not alkaline.

The alkali metals are sodium, potassium, lithium, rubidium, and cesium. They are placed in one group by themselves in the periodic table of elements. Calcium, magnesium, strontium, and barium are not considered to be alkali metals and are often called alkaline-earth metals. They do form alkaline compounds but are different from the alkali metals in many respects and are placed in a different group in the periodic table of elements.

Lithium is universally distributed. It is said to be rarely found in appreciable amounts in ordinary rock but one laboratory has found an appreciable amount of lithium in several samples of cement and clinker (up to 0.13 per cent) through the use of the spectroscope. Rubidium and cesium are rare metals whose occurrence in ordinary rock is less likely than that of lithium. When such metals are present and chloroplatinic acid is used to precipitate potassium as in the A.S.T.M. standard method, rubidium and cesium are precipitated and counted as potassium. Lithium, being left in solution with sodium, is counted as sodium. (See Hillebrand and Lundell's "Applied Inorganic Analysis," p. 518 (1929), John Wiley and Sons, Inc.) Lithium zinc uranyl acetate is less soluble than potassium zinc uranyl acetate and may contaminate sodium zinc uranyl acetate in the quick methods.[5]

It has become so customary to consider sodium oxide and potassium oxide together that we need a simple term to designate them. We also need a term to distinguish between all the compounds of the alkali metals and the water-soluble portion of them. We suggest the following terms:

1. *Total alkali* for all compounds of the alkali metals determined as sodium oxide and potassium oxide. The oxides are added without their equivalency being considered.

2. *Total alkali as sodium oxide* for all compounds of alkali metals determined as sodium oxide and potassium oxide. The percentage of K_2O is multiplied by 0.658 to give its equivalent amount in Na_2O and the product is added to the percentage of Na_2O to give the percentage of total alkali as Na_2O.

3. *Water-soluble alkali* for all compounds of alkali metals which dissolve in water under the given conditions of the A.S.T.M. standard method for water-soluble alkali.[6] They are obtained as pure sulfates but the residue is assumed to be pure sodium sulfate and the percentage of Na_2O is calculated from its weight.

Two ways of reporting total alkali as sodium oxide are explained in Table I. The practice of calculating sodium oxide from the weight of sodium sulfate and potassium sulfate is considered to be permissible in the case of water-soluble alkali because the amount of water-soluble alkali is usually small and depends on the arbitrary manner of leaching cement with water.

[6] See Standard Methods of Chemical Analysis of Portland Cement (C 114 – 40), Section 22, 1940 Supplement to Book of A.S.T.M. Standards, Part II, p. 18.

APPENDIX

PROPOSED ALTERNATE METHOD FOR DETERMINING SODIUM OXIDE AND POTASSIUM OXIDE IN PORTLAND CEMENT[1]

Reagents

1. (*a*) *Zinc Uranyl Acetate Reagent.*—Shake a mixture of 20 g. of uranyl acetate ($UO_2(CH_3CO_2)_2 \cdot 2H_2O$), 60 g. of zinc acetate ($Zn(CH_3CO_2)_2 \cdot 2H_2O$), 5 ml. of glacial acetic acid, and 175 ml. of warm water continuously for about 1 hr. or at intervals for a few hours. If the solution is clear, add a little NaCl or sodium zinc uranyl acetate ($NaZn(UO_2)_3(CH_3CO_2)_9 \cdot 6H_2O$) to the solution and shake it again. It is essential that the reagent be saturated with respect to sodium zinc uranyl acetate at the temperature at which the reagent is used. Allow the reagent to stand until its temperature is constant. Filter small portions of it as required, keeping the temperature as uniform as practicable in all operations involving the preparation of the reagent and alcoholic wash and the precipitation, filtration, and washing of the sodium zinc uranyl acetate.

(*b*) *Alcoholic Wash.*—Add some sodium zinc uranyl acetate to ethanol which contains acetic acid (1 per cent), and shake the solution continuously for about 1 hr. or at intervals for a few hours. Filter portions of the wash as required. (See Paragraph (*a*) in regard to temperature.) The ethanol may be absolute or "95 per cent" and may be pure or denatured according to Formula No. 2b or 3a of the U. S. Bureau of Internal Revenue.

(*c*) *Chloroplatinic Acid.*—Dissolve 5 g. of $H_2PtCl_6 \cdot 6H_2O$ in 95 ml. of water and 5 ml. of HCl (sp. gr. 1.19).

(*d*) *Gladding Wash.*—Dissolve 100 g. of NH_4Cl in 500 ml. of water and add to the solution an amount of K_2PtCl_6 that is more than sufficient to make a saturated solution (about 1 g.). Shake the mixture frequently for 6 to 8 hr., allow it to stand at least 12 hr., and filter. The residue may be used for the preparation of a new supply of the wash.

Procedure

2. (*a*) *Preparation of Solution.*—To 2 g. of cement in a platinum dish, preferably of the flat-bottom type, add 5 ml. of cool water, stir the mixture with a platinum rod, add carefully 10 ml. of HNO_3 (1:1), and continue the stirring until the cement is completely decomposed. Add 10 ml. of $HClO_4$ (60 per cent) and 25 ml. of HF (48 per cent) (Note 1) to the solution and mix it thoroughly with the rod. Remove the rod and rinse it with water. Evaporate the solution to dryness or fumes of $HClO_4$ (Note 2). Cool the dish, wash down the side with a little hot water, and repeat the evaporation. Drive off the excess $HClO_4$ by cautiously moving a flame under the dish or increasing the temperature of a radiator, taking care not to heat the dish to redness. Cover the dish with a watch glass of fused silica or heat-resistant glass and convert the perchlorates to chlorides by using stronger heat but still avoiding red heat. The residue fuses to a brown mass and may glow from an exothermic reaction. The reaction may be carried out by heating a small part of the residue at a time and applying no more heat than necessary to keep the reaction going. After the completion of the reaction, continue the heating for 1 or 2 min. below red heat. Cool the dish and watch glass (Note 3). Rinse the watch glass into a beaker. Add a little water to the dish, let the residue stand a few minutes to soften, and grind it with a glass mushroom or pestle to a smooth paste (Note 4). Wash the contents into the beaker and dilute them to 40 to 50 ml. Boil the contents for 15 min., keeping the volume between 25 and 40 ml. Add a little macerated filter pulp to the contents, and filter the solution through a filter paper of medium or fine porosity into a 100-ml. volumetric flask which contains sufficient HCl to acidify the filtrate (Note 5). Wash the filter paper and residue at least ten times until the volume is nearly 100 ml. Cool the filtrate (Note 6), dilute to the mark, and mix thoroughly.

NOTE 1.—Care should be taken that the acid does not carry any wax from its wax bottle, as organic matter in the presence of $HClO_4$ at a high temperature may cause an explosion.

NOTE 2.—The evaporation requires care as the contents have a tendency to bump or spatter, especially when the dish is in contact with a flame or a hot plate at a high temperature. The best way to handle the evaporation depends on the equipment available to the operator and the organization of his work. If practicable, the dish may be left on a water bath or a hot plate at a low temperature overnight. If the hot plate is too hot, a mat of asbestos may be used under the dish. A radiator may be used in which the solution is heated by infrared reflector drying lamps placed below or above the dish, or both. If a gas-fired radiator is used, its bottom should be closed so that the dish is heated by radiation rather than by conduction. A radiator of this type may be constructed out of stock 2-in. plumbing fittings: Place a 3-in. support ring over a close nipple and screw a cap and coupling on the nipple until they came together and hold the ring firmly. As the iron is thick, a burner of the Meker type may be used for heating. If a similar radiator is made of thin copper or galvanized iron, an ordinary bunsen burner may be used. The contact of platinum with iron should be avoided. If the residue is allowed to stand overnight after the second evaporation, it may be placed in an oven or desiccator to prevent delay the next day due to absorption of moisture.

NOTE 3.—As ammonium chloroplatinate is like potassium chloroplatinate in being insoluble in ethanol, all following steps involving the determination of potassium oxide should be carried out in an atmosphere free of ammonia and ammonium salts.

NOTE 4.—The residue should be thoroughly ground to insure the complete extraction of sodium and potassium chlorides. If the bottom of the dish is round and the grinding cannot be done satisfactorily, the residue may be transferred to a casserole with the aid of water and a rubber policeman. Decant most of the water into the beaker and grind the residue.

[1] This proposed method is chiefly a modification of a method described by Francis W. Glaze, of the National Bureau of Standards, in a paper entitled "On the Direct Determination of Soda in Soda-Lime Glasses by Precipitation as Uranyl Zinc Sodium Acetate," *Journal*, Am. Ceramic Soc., Vol. 14, No. 6, June, 1931, p. 450. The use of uranyl zinc acetate to precipitate sodium was proposed by H. H. Barber and I. M. Kolthoff, "A Specific Reagent for the Rapid Gravimetric Determination of Sodium," *Journal*, Am. Chemical Soc., Vol. 50, p. 1625 (1928). The washing of potassium chloroplatinate with Gladding wash and its direct weighing were suggested by Fred P. Diener of Universal Atlas Cement Co. Many minor suggestions were contributed by a number of analysts.

A determination of sodium oxide and potassium oxide in accordance with Sections 20 and 21 of Standard Method of Chemical Analysis of Portland Cement (C 114 – 40), 1940 Supplement to Book of A.S.T.M. Standards, Part II, p. 16, requires approximately three days. A determination by this alternate method requires approximately two days. The standard method is more suitable for an occasional analysis. The alternate method may be used when a large number of determinations are made or when such a determination is made frequently. The method may present a number of difficulties to an inexperienced operator but they can be overcome with experience. In case of dispute, the standard method should be used.

NOTE 5.—One or two drops of acid are usually sufficient. Filtration under suction may be employed. A convenient arrangement is to use a large bell glass, the edge of which is greased and in contact with a piece of plate glass. The top should have a 1- to 2-in. opening fitted with a two-hole rubber stopper. Insert a funnel and a glass tubing through the stopper. Connect the tubing with a T-shape connecting tube and an aspirator or vacuum pump. The connecting tube enables one to release the vacuum without turning the aspirator or pump off. The end of the tubing within the bell glass should be curved toward the side and fitted with a rubber tubing which extends to the bottom of the bell glass. This prevents the spoilage of work by the back rush of air or water. The arrangement makes it possible to filter directly into vessels of many types and sizes with suction.

NOTE 6.—It is not necessary to cool to any particular temperature so long as the flask and pipettes used in the following steps are calibrated at the same temperature and the temperature of the solution is close to the temperature of calibration.

(*b*) *Determination of* Na_2O.—Transfer a 20-ml. portion of the solution (Paragraph (*a*)) to a small vessel and evaporate it to dryness (Note 7). Cool the vessel, take the residue up in 1 ml. of water, add 15 ml. of the zinc uranyl acetate reagent while stirring, and allow the contents to stand for 30 to 60 min. (Note 8) with frequent stirring. Filter the solution through a weighed (Note 9), 15-ml., fritted glass filtering crucible of medium porosity or a Gooch crucible with suction. Transfer the precipitate to the crucible and scrub and rinse the beaker with a rubber policeman, using small quantities of the zinc uranyl acetate reagent. Wash the precipitate six times with 2- to 3-ml. portions of the alcoholic wash (Note 10), being careful to wash down the side of the crucible, and three times with 4- to 5-ml. portions of anhydrous ether. Draw air through the crucible until the odor of ether disappears, wipe the outside of the crucible with a damp cloth, place the crucible in a desiccator for 1 hr. (or 15 min. if *in vacuo*), and weigh it. Calculate the percentage of Na_2O from the weight of sodium zinc uranyl acetate as follows:

$$Na_2O, \text{ per cent} = W \times 5.0375$$

where W = weight of $NaZn(UO_2)_3(CH_3CO_2)_9 \cdot 6H_2O$, and

5.0375 = ratio of Na_2O to $NaZn(UO_2)_3(CH_3CO_2)_9 \cdot 6H_2O$ divided by 0.4 and multiplied by 100, or $\frac{0.02015}{0.4} \times 100$.

NOTE 7.—The first part of the evaporation may be done over a burner or hot plate with a stream of air directed on the surface and finished on a water bath or in a drying oven at 105 C.

NOTE 8.—The solution should stand at least 1 hr. when the content of Na_2O is low (less than 0.2 per cent).

NOTE 9.—Wash, dry, and weigh the empty crucible just as it is done when filtered sodium zinc uranyl acetate is present.

NOTE 10.—When the reagent and alcoholic wash are mixed and allowed to stand, a white precipitate results which does not dissolve in an excess of the wash. The washing with the alcoholic wash should be done rapidly.

(*c*) *Determination of* K_2O.—Transfer a 75-ml. portion of the solution (Paragraph (*a*)) to a vessel and evaporate the solution to about 5 ml. Add 5 ml. of the chloroplatinic acid to the solution and continue the evaporation on a water bath until the liquid solidifies to a soft mass upon cooling (Note 11). Add 30 ml. of ethanol (85 per cent) to the vessel and grind the residue finely with a glass mushroom. Allow the contents to stand for about 1 hr. with frequent stirring and filter through a weighed, 15-ml., fritted glass filtering crucible of medium porosity with suction. Scrub and rinse the vessel with as little ethanol (85 per cent) as possible. Wash the crucible and residue five times with 3- to 5-ml. portions of ethanol (85 per cent), then six times with the Gladding wash with the suction being shut off and the residue churned up thoroughly with a fine stream of the wash each time (Note 12), and finally six times with ethanol (85 per cent) with care taken to wash down the side of the crucible. Dry the crucible at 105 to 110 C. for at least 2 hr. or 130 to 135 C. for at least 30 min., cool in a desiccator, and weigh. Calculate the percentage of K_2O from the weight of K_2PtCl_6 as follows:

$$K_2O, \text{ per cent} = W \times 12.92$$

where W = weight of K_2PtCl_6, and

12.92 = ratio of K_2O to K_2PtCl_6 divided by 1.5 and multiplied by 100, or $\frac{0.1938}{1.5} \times 100$.

NOTE 11.—The content of K_2O is assumed to be less than 1.5 per cent. Five milliliters of the chloroplatinic acid is about twice the amount necessary to precipitate the potassium in cement having a K_2O content of 1.5 per cent. If the content is much greater than 1.5 per cent, the amount of the acid should be increased in proportion. The liquid may contain so much calcium chloride that toward the end of the evaporation most of the calcium chloride and some of the K_2PtCl_6 may crystallize out, giving slush instead of a syrupy solution. The last stage of the evaporation requires care, and it may be necessary to cool and re-evaporate a few times. If the evaporation is prolonged too long, the chloroplatinic acid may be partially decomposed or the solidified mass may be hard to break up in ethanol.

NOTE 12.—The K_2PtCl_6 is contaminated with considerable material which is insoluble in ethanol but soluble in the Gladding wash. It is thus essential that the washing with the Gladding wash be done thoroughly.

Blank Determinations

3. Make blank determinations, using the same procedure as prescribed above and using the same amounts of reagents. Correct accordingly the results previously determined.

Substitution of Paint for Zinc Coatings

ISSUED AT THE request of the Protective and Technical Coatings Section of the Office of Production Management in the interest of conservation is a report by E. F. Hickson, Chemist, National Bureau of Standards, which suggests paint substitutes available at the time the report was prepared suitable for replacing critical materials such as zinc coatings. Subjects covered include factory-primed exterior sheet steel; painting exterior and interior sheet metal; exterior and interior structural steel; painted wire; protection of metals and related items. A similar report was issued several weeks ago covering use of substitute materials for aluminum paint as prepared by Messrs. Hickson and Gardner. Copies of this latest report can be obtained from the Specifications Branch, Bureau of Industrial Conservation, Temporary Building E, Fourth and Adams Drive, Washington, D. C.

Steel Committee Actions

(*Continued from page 33*)

OTHER ACTIONS

In the field of pipe and tubing in the charge of Subcommittee IX, decision was reached to ask for adoption in 1942 of a change permitting the use of acid Bessemer seamless pipe in the Specifications for Welded and Seamless Steel Pipe (A 53 – 40), one of the most widely used pipe standards. Also, a change of a major nature was the recommendation to allow deductions in existing values of elongations of pipe in A 53 depending upon wall thicknesses paralleling a similar setup in existing plate and structural specifications which have a sliding scale of elongation values. New requirements will provide a basic elongation (strip specimen) for pipe with walls $^5/_{16}$ in. and thicker at 35 per cent minimum for Grade A; 30 per cent minimum for Grade B, and for the standard 2-in. specimen, 25 per cent minimum, Grade A; 22 per cent minimum, Grade B. For pipe with wall thickness under $^5/_{16}$ in., deductions are permitted carrying the minimum for Grade A down to 22.75 per cent for $^3/_{32}$-in. wall and 19.5 per cent minimum for Grade B with $^3/_{32}$-in. wall.

This subcommittee was also authorized to initiate work on specifications for copper brazed steel tubing and welded and seamless steel pipe piles, with early action anticipated. Existing revisions in a number of Subcommittee IX pipe and tubing standards were approved for adoption. In some cases there will be additional changes in the interest of simplification.

The subcommittee on rails and track accessories reaffirmed seven of its specifications which had remained six years without change, thus indicating that they are in accord with current practice.

In the field of structural steel, existing revisions in the Specifications for Steel for Bridges and Buildings (A 7 – 39) are to be adopted which call for the deletion of requirements for eyebar flats. A change setting up additional tests for steel for locomotives and cars (A 113 – 39) as published, will be adopted.

Existing standards covering wire and rail-steel bars for concrete reinforcement (A 82 and A 16) were reaffirmed as being in line with latest commercial practice.

Four tentative specifications (A 235 through A 238) covering carbon and alloy steel forgings for locomotives and for general industrial use are to be recommended for adoption as standard. Subcommittee VI also reaffirmed the Specifications for Carbon-Steel Axles for Cars and Tenders (A 21 – 36).

Minor changes are to be incorporated in the Specifications for Commercial Quality Hot-Rolled Bar Steels (A 107 – 40) affecting particularly permissible variations. There was extended discussion of changes to bring the chemical compositions in line with those agreed upon by the S.A.E. and A.I.S.I., but action was postponed. In the meantime proposed specifications incorporating the latest information are to be drafted.

There was intensive discussion of numerous specifications covering materials for high-temperature service. In addition to the two casting specifications, A 216 and A 217, with emergency provisions as indicated above, there was agreement on one emergency alternate provision to provide that in the Specifications for Nuts for Bolts for High-Pressure and High-Temperature Service to 1100 F. (A 194 – 40) bar nuts will be acceptable in sizes $^1/_2$ in. and smaller where the production jam makes it extremely difficult today to procure forged nuts. Another matter is to delete the requirement for the manufacturer's mark on class O nuts. Following similar action in the field of piping for use at normal temperatures, Subcommittee XXII approved for incorporation as standard, reduced values for elongation of seamless pipe Grades A and B in the Specifications for Lap-Welded and Seamless Steel Pipe for High-Temperature Service (A 106 – 41). The subgroup also discussed the use of killed acid Bessemer seamless pipe and will consider it again at the next meeting, following a study of additional information.

There was a large attendance at most of the meetings with upward of 150 leading metallurgists and engineers present from producing and consuming companies throughout this country and Canada.

Research and Standards Work Continues on Corrosion of Steel

COMMITTEE A-5 ON Corrosion of Iron and Steel held a two-day meeting in Philadelphia on January 14 and 15, with meetings of two of its sections held on January 12 and 13. Reports were considered on the preparation of several new specifications and on studies involving test methods for metallic-coated products. Several research subcommittees described investigations that have been under way on the corrosion of iron and steel products, both coated and uncoated, after exposure to the atmosphere.

The Section on Specifications for Metallic-Coated Hardware under the chairmanship of B. J. Barmack, Commonwealth Edison Co., announced the completion of draft specifications for lead coating (hot-dip) on steel which had been prepared in the interest of conservation of zinc. When approved these new specifications are to be issued as emergency specifications. Also reported was an important revision in the present Tentative Specifications for Zinc Coating (Hot-Dip) on Hardware and Fastenings (A 153 – 33 T), the principal change being the addition of requirements for the uniformity of coating for the four classes of galvanized coatings. The uniformity will be specified according to the minimum number of 1-min. dips which the galvanized material will withstand in the Preece test. These specifications provide detailed requirements for coatings applied to builders' hardware, pole line and transmission line hardware for farm implements, bolts, nuts, screws, nails, rivets, awning pulleys and fittings, and other miscellaneous general hardware.

The Section on Sheet Specifications has decided to undertake the preparation of specifications for terne coated sheets which would include requirements for both long-terne and short-terne coatings.

A section under the chairmanship of R. W. Baker, Republic Steel Corp., has reviewed the dropping test for determining the thickness of zinc and cadmium coatings on

steel. This test is being used in the field as a check test as contrasted with the product control tests now in use, such as those for the uniformity and weight of coating. A report was given on the application of the dropping test to various types of zinc coatings applied by the hot-dip and electrodeposited methods, and of cadmium by electroplating. It is expected this report will be published in an early issue of the ASTM BULLETIN.

The specimens of bare (uncoated) copper-bearing and noncopper-bearing steel and iron sheets exposed at Annapolis, Md., since 1914 have again been inspected, and some additional failures noted. A complete report on the sheets that have rusted through at this test location will be covered in the 1942 annual report of the committee.

The zinc-coated corrugated sheets exposed since 1926 at five test locations also have been inspected and the data obtained will be reported this year.

Additional data have also been obtained from later inspections of the atmospheric corrosion tests of metallic-coated hardware, structural shapes, tubular goods, etc., that have been under way since 1928 at five test locations representing various atmospheric conditions. Eight types of coatings are involved in this program: Hot-dipped zinc, electrodeposited zinc, sheradized (zinc) applied in gas-heated drum, sheradized (zinc) applied in electrically heated drum, electrodeposited cadmium, hot-dipped aluminum, hot-dipped lead (Amaloy) and parkerized. The last published report was in the 1938 *Proceedings* giving results after approximately eight years' exposure. The committee decided to include in the 1942 report a complete tabulation of the data that have been obtained from all inspections of these exposure tests, covering a period of eleven years.

Standards Work Involving Copper Alloys

COORDINATION OF A.S.T.M. standardization work with Federal specifications, in addition to active work in keeping A.S.T.M. standards up to date, characterized the reports and discussions at the meeting of Committee B-5 on Copper and Copper Alloys at the Wardman-Park Hotel, Washington, D. C., on November 7, 1941.

Subcommittee X on Copper-Base Alloys for Sand Castings met in advance of the meeting of the main committee. Among the matters considered was a proposal to adopt two standard alloys for use in the production of bronze bushings and other such castings in place of the large number of slightly varying specifications for such alloys in current use. The proposal was endorsed as sound and the recommendation was made that it be referred to a joint OPM sponsored committee having a preponderance of consumer representatives.

There was active discussion of the "Data on Commercial Coppers for the Information and Guidance of A.S.T.M. Committee B-5" which has been prepared by the Advisory Committee as a guide to uniform requirements and nomenclature in copper specifications under the jurisdiction of Committee B-5. Further consideration is being given to the manner in which this material is to be presented.

The issuance of stickers covering emergency alternate provisions covering the use of Braden and similar types of fire-refined copper in place of electrolytic and lake copper was discussed. Recommendations may be referred to Committee E-10 on Standards in the near future. In this connection Subcommittee VI on Condenser Tubes presented a report approving the use of "emergency-grade" fire-refined copper during the present emergency. A new specification for this grade of copper is now in preparation by a subcommittee of Committee B-2 on non-ferrous metals and alloys. Subcommittee VI also reported on the preparation of new specifications for copper-alloy condenser tube plates and is balloting on their submittal to Committee E-10 for publication as a tentative standard.

1941 was probably the most active year experienced by the Society's Committee B-5. This was in large part due to the emergency situation entailing heavy requirements by the armed services of the country. At the same time the industrial significance of the committee's work has grown markedly and 1942 will doubtless see very little let-up in the work which B-5 must carry on intensively.

Emergency Reduction in Aluminum Content of Die Castings

THE MOST IMPORTANT matter acted on by Committee B-6 on Die-Cast Metals and Alloys, at its meeting in Philadelphia on January 13, was a proposed revision of the Tentative Specifications for Zinc-Base Alloy Die Castings (B 86 – 41 T) to include two alternate alloys having a lower aluminum content than the present alloys No. XXIII and No. XXV. Alloy XXIII requires 3.5 to 4.3 per cent aluminum, and magnesium of 0.03 to 0.08 per cent. Alloy XXV differs by the inclusion of about 1 per cent copper.

The alternate for alloy XXIII, to be designated alloy XXIV, will have an aluminum content of 1.75 to 3.5 per cent; that for alloy XXVI alternate for XXV will be 1.5 to 3.5 per cent.

The proposed minimum tensile strength values for the alternate alloys XXIV and XXVI are 26,000 p[illegible] and 30,000 psi., respectively, compared with existing values of 35,000 and 40,000. These requirements apply on the average of five tension specimens. The minimum required tensile strength on individual specimens is to be 23,000 and 24,000 psi., respectively, compared with values in the existing alloys Nos. XXIII and XXV of 30,000 and 32,000.

In the alternate alloys, the elongation in 2 in. and the charpy impact values will remain unchanged, but the physical values which the specimens must meet after being exposed to water vapor at 95 C. for ten days (stability test) are being changed.

This revision of the specifications is due to the necessity of conserving aluminum and is a direct reflection of the OPM order restricting the amount of aluminum that may be used in the manufacture of zinc-base alloy die castings. The revised specifications will emphasize the fact that alloys XXIV and XXVI are strictly temporary modifications of alloys XXIII and XXV and are intended for use

only during the emergency and where the use of such castings does not involve personal hazard.

Based on a limited amount of data and experience obtained in laboratory tests made by members of the committee, there will be included as information an appendix containing supplementary data respecting these two zinc-base alloy die castings. A preliminary statement on these low-aluminum casting alloys appeared in the August, 1941, BULLETIN, page 17, which summary includes information that has served as a basis for the present revisions.

A survey of the manufacture of brass die-castings indicated that specifications for brass die castings were desirable. Work is being undertaken on the development of new A.S.T.M. specifications which will cover four alloy compositions.

Under the auspices of the committee, tests have been under way regarding the fatigue of three zinc-base alloys. Considerable data have been obtained, and a paper on this subject will be included as an appendix to the 1942 report of the committee.

Notes on Meeting of Committee C-1 on Cement

IMPORTANT RESEARCH and standardization matters in the field of cement received intensive consideration at the two-day meeting of the A.S.T.M. Committee C-1 on Cement held at the Americus Hotel, Allentown, Pa., late in October. There were upward of 100 members and visitors present during the series of meetings.

The very extensive work on sulfate resistance in which 132 cements had been subjected to long-time sulfate resistance tests is to be continued with short-time tests being carried out in several laboratories. These tests include the following: Lean Mortar Bar Test, Sonic Test, Merriman Slab Test, Merriman Sugar Solubility Test, Paul's Water (Floc) Test, and Autoclave Test.

In the project involving time of setting, penetration tests have been studied and, now, in order to outline a program of cooperative tests additional data are being assembled.

A questionnaire is being circulated to interested laboratories to obtain additional information on autoclave apparatus.

Freezing-and-thawing tests were intensively discussed, with an indication that disagreements in results of work already undertaken might possibly have come from lack of standardization in test details.

The working committee concerned with bleeding, plasticity, and workability has developed a suggested test for estimating the sand-carrying capacity and workability of a cement. Additional work is being carried on. Workability measurements will be made by various methods which will include mixing by hand, rubber balloon process, and machine.

Active work in the field of chemical analysis was indicated by the report of the subcommittee chairman, W. C. Hanna. Action is anticipated at the next meeting on an alternate method for rapid determination of sodium oxide and potassium oxides, this method being termed Diener's glaze method. (A report from this committee appears in this BULLETIN.)

In the field of standardization an important move was a recommendation to be submitted to letter ballot on the adoption as standard of the Method of Test for Fineness of Portland Cement by Means of Turbidimeter (C 115 – 41 T).

There was definite divergence of opinion expressed concerning proposed specifications covering portland pozzuolana cements which had been drafted by the Working Committee on Blended Cements with the result that the committee was instructed to study tests for pozzuolanic activity and also to consider long-time tests.

It was decided that one important matter, namely, tolerances for chemical balances, would be brought up for action at the next meeting of the committee.

The chairman of the committee, P. H. Bates, presided at the meetings with L. W. Walter, secretary, and J. R. Dwyer, technical assistant, handling secretarial matters.

Active Work in Concrete Field

THE FALL MEETING of Committee C-9 on Concrete and Concrete Aggregates was held at the Lord Baltimore Hotel in Baltimore, Md., December 6, immediately following sessions of the Twenty-first Annual Meeting of the Highway Research Board. A number of important standardization activities were announced as nearing completion and active progress in other phases of the work in this field was indicated. While no final actions were taken by the committee—since all matters requiring vote will come up at the meeting to be held in the spring—announcements of some phases of the work can be made.

Terms relating to concrete and concrete aggregates received considerable attention. It is expected that definitions covering a flat piece, elongated piece, and water–cement ratio will be proposed. Also a somewhat revised definition for blast-furnace slag will be recommended and the tentative definition for aggregate which has stood on the books of the Society without change since 1928 is to be recommended for adoption as standard.

A number of existing test methods will be revised and brought up to date during the year, among which should be named the Method of Test for Cement Content of Hardened Portland-Cement Concrete (C 85 – 39) which has stood without change since 1936. Two new methods are being whipped into final shape—one a method of sampling fresh concrete, and the other a method for determining air content of freshly mixed concrete.

Specifications for aggregates are expected to be revised and particularly to require a higher proportion of the finer sizes (minus 50 and minus 100) in the fine aggregate. A major revision in the Method of Test for Structural Strength of Fine Aggregate Using Constant Water–Cement-Ratio Mortar (C 87 – 39) is being considered to bring the procedure more nearly in line with that for testing cement in plastic mortar. To effect that revision a comprehensive series of tests is being outlined by the committee in the conduct of which the cooperation of several different laboratories will be asked.

A proposed specification for waterproof paper for curing concrete was presented as information. It is to be sub-

mitted to Committee D-6 on Paper and Paper Products for comment before final action is taken.

The Tentative Specifications for Ready Mixed Concrete (C 94 – 41 T) published last year received considerable attention. A number of revisions were proposed on which the committee will act at its next meeting.

The meeting was directed by Chairman F. H. Jackson, Public Roads Administration, with Acting Secretary Stanton Walker, National Sand and Gravel Association.

Technical Committee on Rubber Discusses Hardness Testing and Specification Simplification

At a well-attended meeting of the Joint A.S.T.M.-S.A.E. Technical Committee A on Automotive Rubber early in December in Detroit, two very significant subjects were thoroughly discussed: namely, the standardization of hardness testing instruments and the main topic for which the meeting had been called—conservation of rubber by means of restriction of specifications. Because the committee experienced difficulty, due to the present emergency situation, in the development of proposed hardness testing instruments, it has been decided to publish detailed methods for standardizing the operation of the Shore Durometer in order that the instrument can be used with the best possible results, and that at the same time there be prepared a conversion chart of Durometer readings to A.S.T.M. readings. The committee also decided to standardize ten of the Durometer instruments, the chairman to select from companies desiring standardized instruments those ten which would give the best opportunity for checking the unstandardized equipment. Each such Durometer will be reserved as a master instrument for checking.

It was the general consensus of the meeting that as an aid in conservation by means of restriction of specifications the number of requirements could be very largely reduced so as to simplify the rubber compounding problem. Following suggestions that rubber stock requirements be set up to cover the range of properties needed, and that bumper and grommet compounds be standardized at once, definite action was taken that such specifications should not include the general use of specific gravity requirements; that Shore Elastometer readings be eliminated; that all ash requirements be eliminated; and that color should not be made mandatory. The committee appointed to carry out the work on this project is headed by W. J. McCortney, Chrysler Corp., and includes eight other members and several alternates. At the meeting Mr. McCortney was selected as vice-chairman of Technical Committee A to assist Mr. L. A. Danse in carrying on the administrative duties of the committee, this action being taken because of pressure on the chairman and the refusal of the committee to accept his resignation. A special subcommittee was appointed to push the standardization of specifications for synthetic compounds with J. H. Doering, Ford Motor Co., designated as chairman. J. D. Morron, United States Rubber Co., secretary of the technical committee, assisted Mr. Danse with the December meeting.

Outstanding Meeting of Committee D-13 on Textile Materials

The registered attendance of 177, including 39 guests, at the regular fall meeting of A.S.T.M. Committee D-13 on Textile Materials held at the Hotel Pennsylvania, New York City, October 15 to 17, inclusive, was in line with the increased membership of the committee which at the time of the meeting was 245.

Following the meetings of the D-13 Advisory Committee and of the subcommittees, a well-attended paper session was held at which the following six contributions were presented:

Report of Special Committee for Testing of Textile Finishes—E. C. Dreby, Research Associate.

Engineering Use of Statistical Techniques in Testing—A. E. Brandt, Soil Conservation Service, U. S. Dept. of Agriculture.

Application of the Statistical Method for Determining Number of Tests for Strength and Elongation of Rayon Yarns—A. G. Scroggie, Rayon Dept., E. I. du Pont de Nemours & Co., Inc.

An Example of the Use of Statistics in a Study of Chemical Test Methods—Lillian Weidenhammer, Division of Textiles & Clothing, U. S. Dept. of Agriculture.

Application of Rank Correlation to the Development of Testing Methods—E. R. Schwarz and K. R. Fox, Massachusetts Institute of Technology.

Report of Activities of Subcommittee A-8 on Glass Fiber—K. N. Mathes, General Engineering Laboratory, General Electric Co.

The paper by Messrs. Schwarz and Fox has been published in the October, 1941, issue of *Textile Research*. Mr. Dreby's report is given on another page in this issue of the Bulletin.

At the conclusion of the formal meetings, 65 members and guests attended a dinner featured by a "Fashion Show" at which members of the committee functioned as manikins within (or without) the limits of their respective abilities.

Recommendations on Standards

The committee expects to recommend to the Society the following standards:

Method of Test for Water Shrinkage and Thickness Swell for Wool Felt

Method of Testing and Tolerances for Jute Reve and Plied Yarn for Electrical and Packing Purposes

Method of Test for Fastness to Atmospheric Gases of Dyes on Cellulose Acetate Rayon

Methods for Identification of Finishes on Textiles (Qualitative)

Research

Typical of the considerable activity within Committee D-13 are the following projects:

Specifications for: Drying ovens.

Methods of Test for: Testing ball warps, determination of regain, twist determination in the single yarn component of a plied yarn, determinations of vegetable matter in wool, acid determination in felt, fastness to soap, mothproofing treatment of pile floor covering after a period of service, determination of the resistance to flame of the pile of a floor covering as used in the average household, and regain by oven drying.

Studies are being conducted on: Tension to be applied in twist determinations, determination of twist tolerances for commercial regain, type of jaws for determination

of strength of heavily plied yarn, temperature and humidity of testing laboratories, shrinkage and slippage tests of rayon fabrics, grade determination of wool from samples obtained by a core boring machine, effect of tension in reeling on the yarn number determination, sensitivity of Type A machines, effect of rate of loading on strength and elongation of cotton yarns, and definitions.

Work is being continued on development of a statistical method of determining number of tests for a desired accuracy, particularly in connection with the application of the statistical method for determining number of tests for strength and elongation of rayon yarns.

Appearance standards on cotton yarns developed by the U. S. Dept. of Agriculture and formerly supplied by that department for use in connection with General Methods of Testing and Tolerances for Cotton Yarns (D 180 – 41) are now being reproduced by the Society and will soon be available; orders can be transmitted to Headquarters. These appearance standards cover five grades of each of the following sizes of yarns:

3.0s to 7.0s	16.5s to 32.0s
7.0s to 16.5s	32s to 65s
	65s to 125s

The committee is working on the development of appearance standards for single and plied yarn chafer fabrics.

Numerous other projects are being considered by Committee D-13, which is indicative that this committee is continuing at a rate of activity that is in line with its record of recent years.

Research Projects

(*Continued from page 7*)

laboratories which analyzed the National Bureau of Standards Standard Samples Nos. 80 and 128. Report presented at the 1941 meeting of the American Ceramic Society and on the basis of the results a new A.S.T.M. Method of Chemical Analysis of Soda-Lime Glass (C 169 – 41 T) has been approved.

Thermal Endurance (Committee C-14).—Several laboratories have been working on the development of a method for determining thermal endurance of glass and studies in particular have involved the shape of the test specimen. Blown articles, drawn rods and fibers, plates and marbles are being investigated.

Glass Construction Block and Tile (Committee C-14).—Numerous tests in progress for several years cover investigation of individual glass block, of panels of glass block, and mortars used with these blocks. Both specifications and test methods are expected to result from this program.

Thermal Insulating Materials

Physical Properties of Preformed Block Insulation; Insulating Cements; Blanket, Flexible, Loose-Fill, and Miscellaneous Types of Insulation (Committee C-16).—Tests for compressive strength and flexural strength of preformed thermal insulating blocks (C 165 – 41 T) have been issued and studies are under way to determine the effect of prolonged heating on preformed block type insulation, one method involving the use of a sieve shaker.

In the field of insulating cements, three methods have been approved for sampling and preparation of specimens, bulk density, and covering capacity and volume change. A new method of test for thickness and density of blanket-type thermal insulating materials (C 167 – 41 T) has been approved. In a study of mechanical stability of wool-type insulation after prolonged heating a sieve shaker method is being investigated.

Thermal Conductivity (Committee C-16).—A joint committee developed a proposed method for measuring conductivity by use of the guarded hot plate, but Committee C-16 before agreeing on the method is investigating the comparative results obtained by different laboratories on several kinds of material.

Paint and Paint Materials

Accelerated Tests for Protective Coatings (Committee D-1).—This ramified work involves studies on house paints, enamels, metal protective finishing systems, and numerous other materials. Resulting from studies made are two new methods: One for preparation of steel panels (D 609), and one for evaluating degree of resistance to rusting (D 610). The latter includes reference standards which are pictorial in character and are believed to represent the most practical means for expressing results in terms that can be understood by various interested parties. For detailed report of test results of enamels on steel and correlation with outdoor exposure, see 1940 *Proceedings*.

Helpful results were obtained by the committee in an extensive questionnaire dealing with accelerated paint coatings. The work on house paints involves laboratory weathering cycles to determine tint retention. Studies are under way on methods for reproducing corrosion and deterioration of metal protective paints by accelerated means (*Proc.*, Vol. 41).

Petroleum Products and Lubricants

Kinematic and Saybolt Viscosity (Committee D-2).—In a comparative study seven laboratories determined Saybolt Furol viscosities at 122 F. on seven samples of oil, and four determined kinematic viscosity on the same samples, results being given in the 1941 D-2 report. This also gives Saybolt viscosities computed from kinematic viscosities by means of W. H. Herschel equations. Based on this work there has been issued a proposed method for converting kinematic viscosity to Saybolt, published for information only (see 1941 "A.S.T.M. Standards on Petroleum Products"; also *Proc.*, Vol. 41).

Neutralization Number and Saponification (Committee D-2).—Tests under way for several years involving variables affecting the results obtained in determining neutralization number have shown that temperature, time, degree of agitation, strength and type of solvent, and strength of alkali affect the level and reproducibility of results. The 1941 D-2 report (*Proc.*, Vol. 41) gives results of comparative tests keeping the variables closely controlled. Based on this work a new test for neutralization number published as information in 1940 and modified this year has been accepted as a new tentative standard to replace the former Tentative Method of Test (D 188 – 27 T).

In addition, a potentiometric method and a "Rapid Method" for determining neutralization number are published as information. The former is an accelerated procedure for determining neutralization numbers on the severely oxidized oils, while the "Rapid Method," as its name indicates, shortens the time factor involved in the present standard.

Carbon Residue (Committee D-2).—A correlation of results obtained with two methods for determining carbon residue—Conradson (D 189) and Ramsbottom (D 524) involving 231 determinations have been plotted and studied and equations developed. A resulting table gives the numerical relationships between the two values (*Proc.*, Vol. 41).

Gaseous Fuels

Measurement of Gaseous Samples (Committee D-3).—Although with equipment erected at the National Bureau of Standards, results of a procedure for testing laboratory wet gas meters while in continuous motion are fairly consistent and reproducible, because of the difference in the results with those obtained with the fractional cubic foot bottle further tests are to be made.

Specific Gravity and Density (Committee D-3).—Extensive tests carried out at the National Bureau of Standards on the eleven specific

gravity instruments are practically completed and it is indicated that several instruments give surprisingly accurate determinations. Fifteen test gases ranging from helium to butane are in the schedule.

Water Vapor Content (Committee D-3).—Intensive work has been carried out at Pennsylvania State College on two methods for the measurement of moisture in fuel gases: Namely, a laboratory method which depends on the absorption of light by the water vapor at a particular wave length in the near infrared, and a field method which depends on the change of color of cobaltous bromide in an organic solvent on the addition of water. This investigation is described by F. C. Todd and A. W. Gauger in a paper on "Studies on the Measurement of Water Vapor in Gases" (*Proc.*, Vol. 41).

Complete Analysis of Gaseous Fuels (Committee D-3).—Thirty laboratories are cooperating in analyzing a standard gas sample of the carburetted water gas type. Over 225 analyses have been reported from laboratories using different apparatus and methods, which information indicates the reproducibility that can be expected and offers a measure of the accuracy attained in computing heating value and specific gravity. It is expected further work will be done on a standard sample of the natural gas type.

Coal and Coke

Determining Sulfur in Coal and Coke (Committee D-5).—Experimental work has been under way on volumetric methods for determination of sulfur in coal and coke. Check determinations of coal ash fusibility have been in progress on a series of coal ashes covering a wide range in fusibility using both gas-fired and electrically heated furnaces to obtain data as how best to specify the furnace atmospheres.

Ignitibility (Committee D-5).—Detailed investigations carried out at Battelle Memorial Institute on factors affecting a method developed at Carnegie Institute of Technology for determining ignition temperature of coal and coke are described in a paper in the 1941 *Proceedings*. The method gives reproducible results which seem to measure inherent character of the fuel. Further work is being carried out to determine whether the values can be correlated with burning characteristics.

Electrical Insulating Materials

I. Insulating Varnishes (Committee D-9): (*a*) *Resistance of Varnish to Alkali.*—About three years ago work was resumed to develop a test method for determining resistance of varnish to acid and alkali and the scope expanded to include resistance to sea water. Two round-robin tests have been under way with five laboratories participating, results indicating that more work must be done to eliminate certain irregularities.

(*b*) *Impregnating Qualities of Varnish.*—Six laboratories are participating in a round-robin test to determine impregnating qualities of varnish used for impregnating electric coils. Previous studies involved penetration, internal drying, and bonding strength.

II. Molded Insulating Materials (Committee D-9): *Mold Design.*—Four different laboratories have submitted results of tests on tensile strength specimens molded under similar conditions. The molds had different clearances between the cavities and their faces. A standard mold design is to be prepared.

III. Laminated Phenolic Sheets (Committee D-9): *Punching.*—Based on a long program of cooperative tests including development of a standard punching die and a high rating system for evaluating edges, surfaces, and holes in specimens, a test for punching quality of laminated phenolic sheets has been issued (D 617 – 41 T). Hardness tests at room temperature or elevated temperatures according to the punching temperature have been found to give an indication of quality. For details, see Appendix, Report of Committee D-9 (*Proc.*, Vol. 41).

IV. Liquid Insulation: (*a*) *Sludge Test.*—Samples of new and used oil are being tested in different laboratories in accordance with two procedures—the sludge accumulation test, and the high-pressure oxidation test (for description of tests, see *Proc.*, Vol. 41).

(*b*) *Dielectric Strength Test.*—This investigation of oil includes a study of momentary discharges, method for high viscosity oils, rate of applying voltage, shape of electrodes, and handling of the sample. Tests for dielectric strength of synthetic insulating liquids are also being studied.

V. Ceramic Products: Porcelain, Glass, etc. (Committee D-9).—Cooperative tests have been under way on methods of testing steatite for mechanical strength. While satisfactory agreement seems to have been reached on flexural strength, more data were required for compressive strength and impact resistance.

Appended to the D-9 report (*Proc.*, Vol. 41) is a "Report of Round-Robin Tests on Power Factor and Dielectric Constant for Glass" describing the work at five laboratories on five different types of glass to help in correlating measuring technique.

VI. Electrical Tests (Committee D-9).—Extensive work carried out on solid dielectrics is described in the paper appended to the D-9 report (*Proc.*, Vol. 41) entitled "Measurements of Power Factor and Dielectric Constant of Ultra High Frequencies." This work resulted in the revision of the Test for Power Factor and Dielectric Constant of Electrical Insulating Materials (D 150 – 41 T).

VII. Insulating Papers and Fabrics (Committee D-9).—A joint committee with Committee D-6 studied the pH method for acidity determination. Possible improvements have been considered, and tests are being undertaken to determine its applicability to condenser paper.

The applicability of an ingenious testing device for determining wet tensile strength of paper is being studied in round-robin tests.

Investigations of procedures for determining thickness which involve three types of micrometers—standard machinists', machinists' with adjusted pressure, and dead weight dial—indicate that the last is equal to the machinists' in accuracy, and an alternate method is to be incorporated in the Test for Thickness of Solid Electrical Insulation (D 374 – 36 T).

VIII. Cloth Tape (Committee D-9).—Tests on elongation characteristics of samples of varnished cloth tape, using a technique which permitted measurement for the first time of actual elongation of samples wound on special mandrels by field men such as cable splicers, will aid in revising elongation and dielectric strength requirements and also assist in establishing most desirable constructional qualifications for this type of tape.

Rubber Products

Automotive Rubber (Technical Committee A of Committee D-11, Functioning as a Joint S.A.E.-A.S.T.M. Committee): (*a*) *Motor Mountings.*—Over 1400 individual determinations were made in cooperative tests on compression set with samples from seven sources in five hardness grades investigated. Ten laboratories cooperated. Results supported were Methods A or B in the A.S.T.M. Methods of Test for Compression Set of Vulcanized Rubber (D 395 – 40 T) and factors were developed for converting Method A values to Method B values.

(*b*) *Bumpers; Hydraulic Brake Hose.*—Much investigative work has been done on bumpers including studies of load deflection, impact tests, and heat failure of bumper stocks, but classifications or test procedures have not yet been effected. The work on hydraulic brake hose, which previously resulted in specifications and tests, was this year augmented by the Tentative Methods of Testing Automotive Air Brake and Vacuum Brake Hose (D 622 – 41 T) with companion S.A.E. specifications (*Proc.*, Vol. 41).

Chemical Analysis.—Active cooperative test programs are under way on methods for determining cellulose and carbon black in rubber compounds.

Abrasion Tests.—One project involves joint work by Subcommittee XIV and a Technical Committee of the Rubber Manufacturers Association to determine the reproducibility of Method B in the Standard Methods of Test for Abrasion Resistance of Rubber Compounds (D 394 – 40) using the National Bureau of Standards abrader. This also involves correlation of this method with the E. I. du Pont abrader (Method A). A new Test for Tear Resistance (D 624) resulted from studies in this work.

Dynamic Fatigue Testing.—A cooperative investigation of the reproducibility of the new Test for Compression Fatigue of Vulcanized Rubber (D 623) is planned.

Life Test.—Eleven laboratories are cooperating to determine the effect of tests made in accordance with the procedure for Accelerated Aging of Vulcanized Rubber by the Oxygen-Pressure Method (D 572 – 41) at temperatures of 80 C. in comparison with 70 C. A comparison of various types of artificial light sources and exposure cycles, together with actual sunlight exposure is also being made in connection with other proposed tests.

Hard Rubber.—Resulting from a large amount of cooperative testing are the Methods of Testing Asphalt Composition Battery Containers (D 639 – 41 T) which cover chemical analysis, tensile strength and elongation, bulge tests, acid absorption, and sensitivity to hot and cold cycles.

Soaps and Detergents

Special Detergents (Committee D-12).—Cooperative work on a method of analysis for tetrasodium pyrophosphate to decide which of two methods of preparation of the material would provide a purer product was followed by analyses of two commercial products for a $Na_4P_2O_7$ content. Agreement among the eleven laboratories is good and individual results were excellent. The committee therefore felt that the new procedure included in the Tentative Methods of Sampling and Chemical Analysis of Special Detergents (D 501 – 40 T) were adequate.

Textile Materials

Tests for Textile Finishes (Committee D-13).—A special committee sponsored research work at the National Bureau of Standards through research associates, the current work having resulted in the development of instruments for evaluating the hand of fabrics with three instruments designed, tested, and improved. Extensive tests have been made with the equipment to determine reproducibility and sensitivity (see technical paper published in this BULLETIN by E. C. Dreby).

Plastics

Tests of Plastics (Committee D-20).—Committee D-20 has a large number of very active research projects under way, some of which have resulted in methods of test which appear in the current Supplement to Part III of the Book of Standards. The following notes outline some aspects of the research work:

Hardness:

Creep.—A program is under way to measure creep under controlled conditions where loads are applied for both limited and long periods of time.

Wear Resistance.—This project involves plastic materials used for bearings. While quite preliminary at this stage, a report is in preparation summarizing tests which need to be developed to evaluate materials.

Thermal Properties:

Thermal Expansion.—Four laboratories reported measurements on several groups of materials using a proposed method developed by the committee. Satisfactory agreement reported.

Changes on Heating.—Progress reported in method of measuring softening temperatures of materials as indicated by distortion under very low loads. Two proposed methods being prepared.

Optical Properties:

Surface Irregularities.—Suitable methods for measuring surface qualities of curved transparent sheets being studied. Comments are to be sent to the chairman, W. R. Koch, at Wright Field.

Permanence Properties:

Effect of Light on Plastics.—Tests are being started to compare the results of exposure to the Kline fog chamber, the quartz mercury arc, the Weatherometer, and the National Carbon arc without moisture, with the results of outdoor exposure.

Effect of Heat on Plastics.—There are round-robin tests under way. Preliminary results show fairly reasonable agreement between laboratories using same procedure.

Effect of Water on Plastics.—Another series of round-robin tests being completed. Results will be tabulated and comparisons made to indicate the merit of the procedure used.

Accelerated Service Tests for Plastics.—First procedure revised on basis of returns and tests being run on limited number of samples whose field behavior is known.

Miscellaneous Subjects

Methods of Determining Consistency (Committee E-1).—A special research committee on industrial flow test with the aid of a grant from the A.S.T.M. research fund is studying the ring-and-ball softening point test comparing results with those obtained with various types of viscosimeters including the capillary tube type and rotating cylinder type. This work is at the Rheological Laboratory at Brooklyn Polytechnic Institute. The committee purposely limited the project to a single test in order that measurable results could be obtained with reasonably limited effort.

Non-Ferrous Production Metallurgy

IF ANY PROBLEM has confronted materials technologists particularly those concerned with production, it is the increased production of a host of non-ferrous metals and alloys. At the same time a great many other technologists have become concerned with non-ferrous metallurgy technique and properties of these metals, to some extent by necessity of substituting for many that are scarce or critical. Consequently the textbook on "Non-Ferrous Production Metallurgy" by John L. Bray, Head, School of Chemical and Metallurgical Engineering, Purdue University, should be of widespread interest and much value.

Following sections devoted to metals and ores and slags and fluxes are chapters covering the most important non-ferrous metals and Chapter XXVII is a condensed discussion of Secondary Metals. The author in preparing his textbook has confined his illustrations entirely to simple line drawings feeling that multiplicity of details is apt to confuse, and further that photographs in many cases serve no useful purpose but that illustrations, if required, can be easily made available through the use of lantern slides in the class.

Each chapter on a metal follows a standard pattern which makes it very easy to obtain information desired if the book is used as a reference. Following history and discussion of economics and statistics, production statistics usually being given in tabular form, there are listed the properties of the metal, marketing and prices, discussion on uses, ores and production, with a list of suggested references on each topic.

Since there are relatively few books on the subject of production metallurgy, this volume should fill a very definite need and it undoubtedly would be of interest to many members of the Society. Copies of the 440-page publication can be obtained from John Wiley & Sons, Inc., New York, at $4 each.

NEW MEMBERS TO JANUARY 12, 1942

The following 67 members were elected from November 28, 1941, to January 12, 1942:

Chicago District

ANDERSON LABORATORIES, INC., C. A. Krause, Secretary-Treasurer, 3920 W. National Ave., Milwaukee, Wis.

FALK CORP., THE, E. J. Wellauer Metallurgist and Research Engineer, 3001 W. Canal St., Milwaukee, Wis.

FELT PRODUCTS MANUFACTURING CO., D. S. Crampton, Manager, Synthetic Rubber Dept., 1504–14 Carroll Ave., Chicago, Ill.

FORBES, D. P., President, Gunite Foundries Corp., 302 Peoples Ave., Rockford, Ill.

LINDSEY, W. M., Chief Metallurgist, South Works, Carnegie - Illinois Steel Corp., 3426 E. Eighty-ninth St., Chicago, Ill.

NEESS, P. F., Chief Inspector, Perfex Corp., 500 W. Oklahoma Ave., Milwaukee, Wis.

SAVAGE, F. K., Chemical Engineer, C. G. Conn, Ltd., Elkhart, Ind.

SIGNODE STEEL STRAPPING CO., Alfred Marchev, Works Manager, 2600 North Western Ave., Chicago, Ill.

SUNDSTROM, S. L., Engineer, The Bastian Blessing Co., 4201 Peterson Ave., Chicago, Ill.

Cleveland District

BEKOLA, J. F., Metallurgist, The Thomas Steel Co., Warren, Ohio.

FENN COLLEGE, STRUCTURAL DEPT., 1987 E. Twenty-fourth St., Cleveland, Ohio.

ZIER, ALBERT, Chemical Engineer, The Glidden Co., Cleveland, Ohio. For mail: 1467 W. 114th St., Cleveland, Ohio. [J]*

New York District

CANADIAN RADIUM AND URANIUM CORP., H. B. Kearney, Sales Manager, 630 Fifth Ave., New York, N. Y.

CHROMIUM PROCESS CO., THE, Norman Tice, President, Derby, Conn.

CONE EXPORT AND COMMISSION CO., J. B. Mellor, Technician, 59 Worth St., New York, N. Y.

MAAS & WALDSTEIN CO., G. Klinkenstein, Vice - President, 438 Riverside Ave., Newark, N. J.

BACHRACH, MAX, Fur Consultant, 370 Seventh Ave., New York, N. Y.

BECKER, E. D., Analytical Chemist, Shell Oil Co., Inc., New York, N. Y. For mail: 456 W. 141st St., New York, N. Y. [J]

CARSON, R. W., Development Director, Instrument Specialties Co., Inc., Little Falls, N. J.

DANZKER, LEO, Associate Inspector, Ordnance Materials, U. S. War Dept., New York Ordnance District, 80 Broadway, New York, N. Y. For mail: 1691 Fulton Ave., New York, N. Y. [J]

DIGGIN, M. B., Chief Chemist, Hanson-Van Winkle-Munning Co., Matawan, N. J.

FRASER, O. B. J., Director of Technical Service on Mill Products, The International Nickel Co., Inc., 67 Wall St., New York, N. Y.

GEISENBERGER, L. H., Chief Chemist, Research Laboratories, Johns-Manville Corp., Manville, N. J.

JOHNSON, J. O., Chief Engineer, Aircraft - Marine Products, Inc., 286 N. Broad St., Elizabeth, N. J.

JONES, R. C., Student Engineer, Combustion Engineering Co., Inc., 200 Madison Ave., New York, N. Y. [J]

LIMAN, LEONARD, Chemical Engineer, The Permutit Co., New York, N. Y. For mail: 1516 Plimpton Ave., Bronx, New York, N. Y. [J]

MACCALLUM, CLARENCE, Consulting Engineer, 12 Reid Ave., Port Washington, N.Y.

NIRENBERG, R. P., U. S. Government Inspector, Jeffersonville Quartermaster Depot, Inspection Branch, Jeffersonville, Ind. For mail: 165 E. Nineteenth St., Brooklyn, N. Y. [J]

SMITH, A. V., Chief Engineer, Homelite Corp., Port Chester, N. Y.

SMITH, HOWARD V., Chief Chemical Engineer and Head of Technical Dept., Barber Asphalt Corp., Barber, N. J.

TAILBY, R. V., Factory Manager, Architectural Tiling Co., Inc., Cass and Jackson Sts., Keyport, N. J.

WHITE, J. R., Instructor in Civil Engineering, College of the City of New York, 139th St. and Amsterdam Ave., New York, N. Y.

WINNICK, R. L., Assistant Inspector of Naval Material, U. S. Navy, New York, N. Y. For mail: 2604 University Ave., Bronx, New York, N. Y. [J].

WOOD, DONALD, Research Engineer, R. Wallace and Sons Manufacturing Co., Wallingford, Conn.

Philadelphia District

AUTOCAR CO., THE, W. J. Diederichs, Metallurgist, Ardmore, Pa. [S]†

LA FRANCE INDUSTRIES, Howard Bateman, Cost Accountant, 4631 Adams Ave., Philadelphia, Pa.

JOYCE, EDWIN, Iron and Steel Branch and Bureau of Industrial Conservation, Office of Production Management, Temporary Building E, First Floor, Eighth Wing, Fourth and Adams Drive, S. W., Washington, D. C. For mail: 149 S. Rolling Road, Springfield, Delaware County, Pa.

PIERCE, H. W., Welding Engineer, New York Shipbuilding Corp., Camden, N. J.

Pittsburgh District

SAYLES, B. J., President, The Calorizing Co., Box 8742, Wilkinsburg, Pa.

St. Louis District

CRAWFORD, J. L., Vice-President and General Manager, Walsh Refractories Corp., 4070 N. First St., St. Louis, Mo.

WINTERKORN, H. F., Associate Professor in Soil Mechanics, Department of Civil Engineering, University of Missouri, 94 Engineering Laboratories, Columbia, Mo.

Southern California District

BRULATOUR, J. L., Engineer, H. Collier Smith, Jr., Co., Inglewood, Calif. For mail: 505 W. Queen St., Apartment 3, Inglewood, Calif.

EKMAN, A. T., Test Engineer, Leeds, Hill, Barnard & Jewett, Los Angeles, Calif. For mail: 509 E. El Camino, Santa Maria, Calif.

HARPER, W. W., Police Physicist Pasadena Police Dept., Pasadena, Calif. For mail: 615 Prospect Boulevard, Pasadena, Calif.

JUMPER, H. D., Civil Engineer, Consolidated Rock Products Co., Los Angeles, Calif. For mail: Box 2950, Terminal Annex, Los Angeles, Calif.

LEEG, K. J., Director of Research, Baker Oil Tools, Inc., Vernon, Calif. For mail: 1824 W. Forty-first Drive, Los Angeles, Calif.

Los Angeles, City of, Department of Water and Power, Bureau of Water Works and Supply, H. A. VAN NORMAN, Chief Engineer and General Manager, Box 3669, Terminal Annex, Los Angeles, Calif.

SMITH, RICHARD S., General Manager, Cook Heat Treating Corp., Los Angeles, Calif. For mail: 4356 E. Fifty-seventh St., Maywood, Calif.

U. S. and Possessions

Other than A.S.T.M. Districts

AMERICAN OIL CO., J. M. Klein, Chief Chemist, American Building, Baltimore, Md.

WINTERS & CRAMPTON CORP., I. C. Hepfer, Director of Research and Laboratories, Grandville, Mich.

BUCHERT, JOHN, Chemist, La France Industries, La France, S. C.

BUCK, R. M., State Planning Engineer, Work Projects Administration, Federal Works Agency, Box 555, Boise, Idaho.

* [J]—denotes Junior Member.

† [S]—denotes Sustaining Member—see article on Sustaining Members, p. 36.

CHAMBERLIN, J. W., Director, Research Laboratory, American Machine and Metals, Inc., East Moline, Ill.

DE ROPP, H. W., Manager, Process Section, Belle Works, E. I. du Pont de Nemours and Co., Inc., Box 1537, Charleston, W. Va.

FIRTH-HAND, J. F., Chartered Civil Engineer, Colonial Supply Liaison, British Supply Council, 907 Fifteenth St., Washington, D. C.

LAVEN, BARBARA F., Textile Engineer, Jones, Gardner & Beal, Inc., Providence, R. I. For mail: 39 Fuller St., Brookline, Mass. [J]

POOLE, J. W., Research Manager, Lion Oil Refining Co., Exchange Building, El Dorado, Ark.

SCHWARTZKOPF, J. B., Chemist, NOBLITT-SPARKS Industries, Inc., Columbus, Ind.

THROOP, J. F., Instructor, Department of Mechanics, Rensselaer Polytechnic Inst., Troy, N. Y. [J]

WALLACE, H. W., Junior Engineer, U. S. Engineer Office, St. Paul, Minn. For mail: 579 Sherburne Ave., St. Paul, Minn. [J]

ZONGE, R. D., Chief Metallurgist, Lycoming Division, The Aviation Corp., Williamsport, Pa.

Other than U. S. and Its Possessions

GYPSUM, LIME AND ALABASTINE, CANADA, LIMITED, J. H. Robinson, General Superintendent, 50 Maitland St., Toronto, Ont., Canada.

UNITED WIRE WORKS, LTD., RESEARCH LABORATORY, I. E. Ewen, Broompark Ave., Granton, Edinburgh, 5, Scotland.

DURRUTY, C. A., Chief Chemist, Bunge y Born, Lda., Buenos Aires, Argentina. For mail: Arcos 4558, Buenos Aires, Argentina.

GARRETT, F. DE L. DE A., State Engineer, and Director Engineer, The Research Laboratory, National Board of Cork, Ministry of Economy, Lisbon, Portugal. For mail: 4 Rua de Buenos Ayres, Lisbon, Portugal.

HOSKINS, H. G., Research Metallurgist, Northern Aluminium Co., Ltd., Banbury, Oxfordshire, England. [J]

KENNEDY, D., Chief Chemist, Cia. Uruguaya de Cemento Portland, Calle Zaballa 1338, Montevideo, Uruguay.

STUART, J. K., Production Engineer, Holdens Motor Body Builders, Division of General Motors-Holdens, Ltd., Woodville, South Australia.

PERSONALS

• • • News items concerning the activities of our members will be welcomed for inclusion in this column.

H. P. BIGLER, for 16 years Managing Director of the Rail Steel Bar Association at Chicago, has been appointed Assistant to the President of Connors Steel Co. with headquarters at Birmingham, Ala. Mr. Bigler has long been active in the field of engineering standards, taking active part in Committee A-1 on Steel and its Subcommittee V on Reinforcement, and also as a representative of the Society on the Joint Committee on Concrete and Reinforced Concrete. He has recently been appointed chairman of the Technical Advisory Committee on Reinforcement Steel, National Emergency Specifications, OPM (see article in forepart of this BULLETIN). Mr. Bigler continues as a director of the Rail Steel Bar Association, and in this position will continue to represent the work of that industry in trade and technical committees. MR. W. H. JACOBS, also a member of the Society, succeeds Mr. Bigler in charge of the Association's Chicago office.

L. S. REID, Senior Technician, Standardization Laboratory, Metropolitan Life Insurance Co., chairman of the Society's Committee D-6 on Paper and Paper Products, has been appointed Consultant on Pulp and Paper in the Conservation and Substitution Branch in the Bureau of Industrial Conservation, OPM, Washington.

W. M. COY has temporarily discontinued his connection with the United States Rubber Co., New York, N. Y., and is now in the service stationed at the Naval Aircraft Factory, Philadelphia, Pa.

F. M. HARRIS, Chairman of the Northern California District Committee of the Society, is now in active service with the Navy. In his absence DOZIER FINLEY, Vice-Chairman, Director of Technical Research, The Paraffine Cos., Inc., is in charge of the District Committee, serving with the Secretary, T. P. DRESSER, JR., Chief Engineer, Abbott A. Hanks, Inc.

V. N. CRIBB, who was Experimental Engineer, Williams Oil-O-Matic Heating Corp., Bloomington, Ill., is now a Lieutenant at Edgewood Arsenal, Md.

H. B. OATLEY, Vice-President, The Superheater Co., New York, N. Y., is the new vice-chairman of the Boiler Code Committee of the American Society of Mechanical Engineers.

C. N. FORREST, who last year received his forty-year certificate representing membership for four decades in A.S.T.M., has announced his retirement from the Barber Asphalt Corp., effective as of December 31, 1941. He is planning to continue in consulting service at his home, 1 DeWitt Road, Elizabeth, N. J.

JOSEPH MARIN, formerly Associate Professor of Civil Engineering, Illinois Institute of Technology, Chicago, Ill., has been appointed Professor of Engineering Mechanics, Pennsylvania State College, State College, Pa., effective as of February 1.

ARTHUR W. CARPENTER, Manager of Testing Laboratories, The B. F. Goodrich Co., Akron, Ohio, member of the Executive Committee, is on loan from his company and is serving as a member of the staff of the Conservation and Substitution Branch, Bureau of Industrial Conservation, in Washington, with offices in Temporary Building E, Fourth and Adams Drive.

RALPH WILSON, Metallurgical Engineer, Climax Molybdenum Co., Canton, Ohio, is also on loan from his company serving in the Iron and Steel Branch as assistant to H. L. R. Whitney. He also has offices in new Temporary Building R to which the Iron and Steel Division of OPM has recently moved.

At the annual meeting of the Textile Research Institute, Inc. (formerly the U. S. Institute for Textile Research) H. DEWITT SMITH, Treasurer and Textile Technologist, The A. M. Tenney Associates, Inc., New York, was elected *Treasurer*. The new executive committee was announced as comprising, under the revised by-laws, the officers and the chairmen of the standing committees, two A.S.T.M. members being included, as follows: W. D. APPEL, Chief, Textile Section, National Bureau of Standards; and D. G. WOOLF, Editor, *Textile World*.

ALAN MORRIS, formerly Chief Metallurgist, Bridgeport Brass Co., Bridgeport, Conn., is now Director of Research for the company.

G. J. COMSTOCK, Associate Professor, Stevens Institute of Technology, Hoboken, N. J., has been appointed Professor of Powder Metallurgy.

The following A.S.T.M. members were among the officers nominated for 1942 by the American Association of Textile Technologists: ALEX SOMMARIPA, Manager, Fabric Development, E. I. du Pont de Nemours & Co., Inc., *First Vice-President;* BERNICE S. BRONNER, Director, Textile Laboratory, Good Housekeeping Institute, *Secretary;* and EPHRAIM FREEDMAN, Director, Macy Bureau of Standards, R. H. Macy and Co., Inc., *member of the Board of Governors*.

C. D. YOUNG, Colonel, U. S. Engineer Corps Reserve, and Vice-President, The Pennsylvania Railroad Co., Philadelphia, has been appointed Chief of the Materials and Equipment Section, Defense Transportation Office, the appointment having been made by Joseph B. Eastman, Director of Defense Transportation. Colonel Young, an A.S.T.M. past-president, saw service in the Spanish-American and First World Wars.

At the annual meeting of the American Council of Commercial Laboratories held recently in New York the following A.S.T.M. members were elected to office for 1942: A. R. ELLIS, President, Pittsburgh Testing Laboratory, *President;* W. P. PUTNAM, President, Treasurer, and Technical Director, The Detroit Laboratory, *Vice-President;* D. E. DOUTY, President, United States Testing Co., Inc., *Secretary;* and T. A. WRIGHT, Technical Director and Secretary, Lucius Pitkin, Inc., *Treasurer*.

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